ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

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Measuring the Velocity of Projectiles.

That the Germans occupied themselves already more than forty years ago with direct measurement of the velocity of projectiles by means of the electric current, appears from a short description written by myself, which had entirely escaped my memory, and which I find again by accident in the *Konst and Letterbode*, published in Haarlem, Netherland, March 31, 1843. I add here the translation:

"NEW APPLICATION OF ELECTRICITY IN CHRONOMETRY.

"Leonhard, clock and watch maker, Berlin, Germany, has recently constructed a timepiece which surpasses all thus-far-constructed clocks in accuracy, as it is intended to determine the time to within the one-thousandth part of a second. It is intended for the artillery, to determine the velocity of cannon balls by the time they require to reach the target, which is placed upon a certain definite distance (about 500 meters). A very light hand revolves over a metallic face-plate, making one revolution in one second, being connected with a conical pendulum of peculiar construction, so as to regulate the motion, while the face-plate is at its circumference divided into 1,000 parts. The hand may be started at any moment and stopped suddenly, but it is evident that if this were done by hand it would be impossible to attain any accuracy; therefore, a galvanic circuit is established between the cannon, the target and the timepiece At the moment that the ball leaves the cannon the current is closed, and the hand started by means of an electro-magnet. When the ball perforates the target, the current is interrupted, which stops the motion of the hand. The number of divisions passed over by the hand shows the thousandths of a second that it took the ball to pass over the distance of 500 meters. The apparatus is enclosed in a strong box, easy of transportation, and costs nearly 3,000 florins. "P. H. VAN DER WEYDE.

"Lienhead, February, 1843."

I ought to add here, for the information of the readers of the ELECTRICAL REVIEW, that an improved apparatus of this day is in use at the Government test station of Sandy Hook, and used there for testing guns, projectiles, and various kinds of powder. The principle upon which it operates is quite different, as it consists in a metallic perpendicular rod, which begins to fall at the moment of firing, while at the instant the ball penetrates the target the interruption of the current causes the rod to receive the indentation by a steel point at its side, by which the time elapsed between the two periods is determined by the distance of the indentation from the starting point of the rod, because it is well known with what velocity a rod is falling at every moment of its downward course. This method is so correct that it is not necessary to place the target at any great distance. Ten to twenty feet is sufficient, as was proved by Mr. H. B. Sinclair, electrician U. S. proving ground at Sandy Hook, and who kindly exhibited the apparatus last winter before the New York Electrical Society, and made practical experiments with the same, to the intense gratification of the members, and this over the short distance allowable in their regular place of meeting.

V. D. W.

Multiplex Telephony.

Editors of the Electrical Review.

The great increase in the last few years in the number of telegraph and telephone wires running through our streets has stimulated inventors to try to find means of sending several messages over one wire at the same time. In the case of the telegraph, this has been, in a measure, successfully accomplished; but no practicable method has as yet been presented to the public, by means of which the same could be done with the telephone.

The following is a simple method, by means of which an electrician of this city proposes to accomplish this object.

The simplest case, and the one best adapted to illustrate the method, is that of connecting the telephone exchanges of two cities:

1, 2, 3, 4, 5, and 6 are large wires (see sketch) running from one exchange to the other. If each of the wirers of the group *A* be connected with 4, we have three independent circuits. If, now, we connect each of the wires of the group *A* with 5, we have three more circuits, which, however, are not quite independent of the first three. Each of the wires of group *A* may also be connected with 6, giving three more circuits—nine in all. None of these circuits are independent; *i. e.*, the entire current of electricity will not in any case be entirely confined to one circuit. If, however, we make the resistance of the numbered wires very low, and that of the lettered wires very high, all of these circuits become practically independent, and having nine circuits in six wires, we can transmit nine messages at one time. If we had eight numbered wires we could transmit sixteen messages at one time.

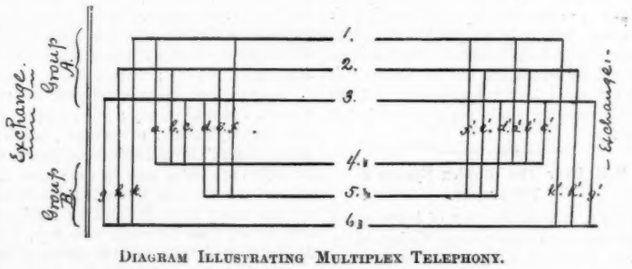


DIAGRAM ILLUSTRATING MULTIPLEX TELEPHONY.

In general, if the number of numbered wires be represented by $2n$, the number of messages that can be transmitted at one time is n^2, and the number per wire is

$$\frac{n^2}{2n} = \frac{n}{2}$$

or one-fourth as many as there are wires. Hence, it will be seen, that with 100 wires we could transmit 2,500 messages at one time.

Each of the wires of one set, *A* or *B*, may also be connected with the earth, giving *n* more circuits.

The case just described is the most simple, although it contains the principle on which similar systems may be elaborated for cities. The same principle might also be applied to telegraph lines.

There seems to be one objection to the system, namely, the cost of the numbered wires which must, in general, be quite long and very heavy; but where the number of messages required to be sent at one time is very large, the cost of plant is greatly decreased in proportion. JOHN A. FINNEY.

Baltimore, Md., Sept. 8 1885.

An Electric Eel.

"Any one who lifts that eel out of the tank may have it," said Eugene Blackford to a crowd of persons who stood in New York's Fulton Market before an open aquarium, watching a large eel moving gracefully about in the water. It attracted attention because it was not a common looking eel, such as may be bobbed for any day at low tide in Newtown Creek. A hardy-looking fisherman, who had probably caught many eels in his time, asked Mr. Blackford if he was in earnest, and being assured that the offer was made in good faith, he tucked up the sleeve of his pilot jacket and, after briefly explaining to the crowd the precise manner in which an eel should be grasped to prevent it gliding through the fingers, he plunged his hand into the water to practically illustrate how the thing was done. He seized the eel very artistically, but, with a sharp explosion of blasphemy, he let it go again before he had brought it to the surface. The eel swam around indifferently. It had evidently grown accustomed to such experiences. The fisherman followed it with his eyes. "It stung me bad," was the only explanation he cared to offer to the wondering spectators. Just then a whistling boy came up, and looked at the eel because the others were looking at it. "I don't see anything uncommon in him," he said, contemptuously. "I've ketched bigger ones than that."

"Say, Bob," said the fisherman, struck with an idea, "pick that eel out of the tank and follow me down South street with it, and I'll give you a quarter."

Without stopping to make any inquiries as to the legitimacy of the offer, the independent lad grasped the eel. He liberated it immediately, and uttered a yell that brought in the policeman who twirls his club just outside the fish market, to see what the matter was.

Later in the day many persons touched the eel and tested its curious powers. After the contact some shrieked, some laughed, and some looked frightened, but none essayed to meddle with it a second time. New comers continued to touch it, until Mr. Blackford, fearful that its vitality might be exhausted, put it into a high, closed tank, and pasted this legend on the glass: "Gymnotus, or electric eel." The tank contained several 'hell-benders," and the eel shocked them very much, and caused them to spring around in the liveliest manner. It was given to Fish Commissioner Blackford by Mr. Donald Burns, of 117 Roosevelt street, who received it from the Amazon river. Captain Bears brought it with him in the steamship Finance. It is rather a handsome creature, and a great point in its favor is that it keeps its mouth always shut, except at meal times, and seems to breathe through two rows of holes on its head and neck. It is about 2½ feet long, and rather disproportionately thick. It has a heavy fin, like the keel of a boat, running along the belly the entire length of the body. The throat is of orange color, and the head, though short and clumsy, is ornamented with two little flaps that look like ears. It can administer an electric shock as powerful as that of a small battery. A man touched it with a steel fish knife, and he felt the shock as forcibly as if he had touched it with his bare fingers.

THE WESTERN ELECTRIC COMPANY'S NEW ANNUNCIATOR.

A New and Reliable Annunciator.

The Western Electric Company is just introducing a new annunciator for which they expect large sales. It indicates by dropping a slide instead of turning a needle or dropping a shutter as in the annunciators in general use. It requires no adjustment and therefore cannot get out of adjustment. It is very neat in appearance, and we understand that the price of it puts it in competitor with any in the market. The annunciator made for four numbers is illustrated in this edition.

—— Mr. B. F. Van Dyke, of Philadelphia, will represent the Schuyler Electric Light Company in that city. Mr. Van Dyke, who is a capable and energetic gentleman, will do good work for his company in his territory. His headquarters are at 914 Walnut street.

Meeting of the National Electric Light Association.

However skillful the mechanician, he may reasonably hope to gain something by a comparison of work with his fellows. The one may have found a simple means of performing what before was a difficult operation, and the other hit upon a plan reducing the cost of operation. Let them come together and exchange ideas, and it is readily seen that both will be benefited. This comparison of work is of the most importance where new processes are in course of development. Seeing this, the electric-lighting fraternity have at last bestirred themselves, and formed an organization for mutual advantage and instruction. This organization, called the National Electric Light Association, met last week at the Union Square Hotel, New York city, and the three days' sitting of the convention brought out much that is interesting to the general public and a great deal that is of importance to those engaged in operating electric-lighting plants. The most important papers and addresses were upon the advantages of electricity as an illuminant, proper construction and arrangement of engines and boilers, incandescent lighting, past and present, tower system of electric lighting, and underground wires.

The value and necessity of comparison of processes was clearly illustrated at many points in the discussions. Allowing for the difference in price of coal in one section of the country and another, some were found to be paying twice, and in one case—a plant in Iowa—nearly four times as much for the maintenance of 2,000 candle-power arc lights as others. This disparity in cost was shown to come from the use of engines not fitted for the work, or from bad arrangement of grates and boilers. It was shown that shafting is a great waste of power in an electric light machine, and the use of countershafting a positive waste of money. Those plants give the best satisfaction, and are most economical, in which the engines and dynamos are coupled up directly. A curious fact was brought out during the meeting concerning the effect of the introduction of electric lighting upon the business of the gas companies. It would naturally be supposed that, when the electric light came to be generally used in the streets and offices of a town, there would be a relative diminution in the demand for gas. Yet the contrary, it seems, is the case. It was testified to in the convention, and confirmed on all sides, that wherever the electric light was introduced the gas companies greatly increased their business. This phenomenon is thus accounted for: The public get accustomed to more light, and therefore use more gas burners. Stores and show-windows where gas is used look dim and dingy near others lighted with electricity, by reason of the contrast, and this appearance can only be rectified by turning on more burners.

In the paper on tower-lighting, the author scarcely maintained his point that it was more efficient than pole-lighting for the illumination of cities, though it seems to have some advantages, notably that of being less trying to the eyes. He cited the case of the lighting of Detroit, Mich., by a system of iron towers and masts, similar to those in use in Union and Madison Squares in New York city. The area to be lighted is 10½ square miles. The system comprised 90 skeleton iron towers, being for the most part 150 feet in height. In the thickly populated districts these towers are placed in the form of triangles, something less than a fifth of a mile apart, while in the outskirts of the city they are half a mile apart. There are nearly four hundred 2,000 candle-power voltaic arc lights in all, and so thoroughly was the city illuminated by these last year, and so satisfactorily, that the citizens, so the author said, demanded the renewal of the electric-light company's contract for the coming year.

The cost to the city of Detroit is, it seems, more than double what it was with gas, but the electric-light people insist that the city is furnished with more than twice as much light as formerly; and, whether this is so or not, the city inferentially shows its appreciation of electric lighting by its renewal of the contract, though there is reason to believe that even more satisfaction would be given by the use of the ordinary pole lighting, such as is in use in Broadway, Fifth Avenue, and other New York streets.

The paper on underground wires, though the last to be read, is perhaps of the most interest to the general public, owing to the present controversy and complication. The author began with something like a eulogy of a certain telegraph company, which has not particularly attracted attention for broadness of policy or for commendable practices. This company, according to the author, began burying its wires ten years ago, but recently it has been discovered that the gutta-percha insulation of its line has been destroyed by the effects of the steam-heating pipes, and it has been abandoned. The system used was that in vogue in England—the simple drawing of gutta-percha cables through ordinary gas pipe.

In the opinion of the author, and he has had an extensive practical experience in such matters, the sinking of the arc-light wires is an exceedingly difficult problem, which will require much thought and many dollars to solve. He said: "So far as the arc-light companies are concerned, the present movement is well timed, as reconstruction would have to be begun in any event. The present lines are not of a permanent character, and the insulation is not in the best condition. I believe that the subway commission will prepare a plan for the accommodation of all services, and that when it is carried out, all companies can by lease or purchase obtain perpetual rights in such subways. No system will be approved that is not sufficiently comprehensive to meet the demands of all classes of service." But later on in the paper the problem of burying the arc-light wires appeared not to be so difficult after all, for the author described a system of underground conduits now in use in Chicago, in which these arc wires work well along with telephone and telegraph wires. This conduit, he said, is made of concrete, the result of mixing asphaltum and silex, and is moulded and at the same time hammered into lengths of about three and a half feet, through which are formed at the same time longitudinal ducts, the whole looking not unlike a tubular boiler. One end is provided with a flange to allow for the secure joining of the section; being cemented with the same material of which they are made—applied hot. Manholes are arranged at the intersections of the streets for renewing and repairing.

Perhaps this Chicago line, though entirely successful thus far, should be regarded as a makeshift, rather than as a permanent construction. For it is not yet known, as the author inferentially admitted, whether or no it would withstand the test of time as well as it withstood the government test of 5,500 pounds crushing strain per inch.—*Scientific American.*

Suit Over the Duplex System of Telegraphy.

Quite a formidable array of lawyers and electricians confronted Judge Wallace in the United States Circuit Court one morning last week when argument was opened in the injunction suit brought by the Western Union Telegraph Company to restrain the Baltimore & Ohio Telegraph Company from the further use of the duplex system of telegraphy which is claimed to be the exclusive property of the Western Union under the original patent of Joseph B. Stearns and its subsequent reissues direct to the Western Union Company.

The court room was transformed into a temporary operating room, and during the course of the proceedings the learned Judge descended from the bench on several occasions to inspect the mechanical appliances in connection with the explanations of experts and arguments of counsel. In the legal conduct of the case the Western Union Telegraph Company was represented by Edward N. Dickerson, Gen. Samuel A. Duncan and C. L. Buckingham, and the Baltimore & Ohio Telegraph Company by Edward R. Bacon, Grosvenor P. Lowery, Frederick H. Betts, Rockwell Kent and J. E. Hindon Hyde.

A formal demurrer on the part of the Baltimore & Ohio Company was denied by the Court. Voluminous documentary evidence on both sides was then submitted, and argument commenced. The day was chiefly devoted to elaborate explanations, by the aid of the wires and instruments which had been taken into court, of the nature and operation of the duplex system of telegraphy to the use of which the Western Union claims exclusive right. It appeared in evidence that when the telegraph system of Professor Morse was first put in operation between Baltimore and Washington in 1844, two line of wires were used; one for transmitting from Baltimore to Washington, and the other for transmitting from Washington to Baltimore. Each line wire, or circuit, was independent, and was provided with a battery and key at its sending end, and an electro magnet and armature, which constituted the essential parts of the receiving instrument at its receiving end. In 1845 Ezra Cornell invented the "open circuit system," by which one of these line wires was dispensed with. In 1848 the system was introduced into Germany, and afterward into other European countries, and upon it were based the improvements in double transmission, or duplex and quadruplex telegraphy now in use. In order to overcome the obvious imperfections of the early system, successful inventions were made by Dr. Gintl, of Austria, in 1853, and by Professor Frischen, of Hanover, in 1854. Subsequent improvements were also made but all of them were based upon the same general principle as those of Gintl and Frischen, until the year 1872, when Mr. Joseph B. Stearns, of Boston, patented a new and very valuable invention to prevent the effect upon the relay at the sending station of the return current due to the static induction of the line, and which consisted in connecting a condenser with any transmitting apparatus. This patent was acquired by the Western Union Company in January 1873, and in February of the same year was re-issued to that company. Nine years afterward, namely, in February, 1882, the company secured a other re-issue of what they claimed to be the same patent, but in three divisions, making nine separate claims. Counsel for the Western Union Company presented affidavits of Louis N Kirschbaum, formerly an operator in the Baltimore & Ohio office, Moses G. Farmer, electrical engineer, Henry C. Townsend, who was assistant examiner in the Patent Office in 1872; Dr. Norvin Green, president, and Gen. T. T. Eckert, general manager of the Western Union; Alfred S. Brown, general superintendent of the Mutual Union Telegraph Company; Gerritt Smith, Fred. O. Nourse, and other employees of the Western Union Company; all in support of that company's claim, to the effect, in brief, that the Stearn's invention is the only successful duplex apparatus now in use; that the right of the Western Union to its exclusive use has never been disputed or infringed upon by any other telegraph company, save the Baltimore & Ohio, and the re-issue of the patent of 1882 contained no new or vital principle not included in the original invention as patented 1872. Dr. Green complains that the appropriations of this duplex system by the Baltimore & Ohio has enabled that company to give the public lower rates on messages, and that this operates to reduce the profits of the Western Union. Accordingly, appeal is made to the Court for an order compelling the Baltimore & Ohio to discontinue the use of the duplex apparatus on all its lines, wherever employed, throughout the country.

An elaborate answer to this plea has been put in by the Baltimore & Ohio Company, supported by sworn statements of D. H. Bates, president and general manager of that company; Frank L. Pope, of New York, electrical engineer; Frank L. Freeman, electrical expert, of Washington; Charles R. Cross, Professor of Mechanical Engineering in the Massachusetts Institute of Technology; Charles F. Chandler, Lecturer on Electricity and Professor of Chemistry in the New York School of Mines, College of Physicians and College of Pharmacy; Arthur W. Wright, Professor of Physics in Yale College; Henry B. Renwick, Civil and Mechanical Engineer; Chas. Cuttriss, Chief Electrician of the Commercial Cable Company; John Rapieff, formerly electrician for the Russian Government; Joseph W. Larish, manager of the Baltimore & Ohio Company's system of wires; William Mayer, Jun., electrician of that company, together with other testimony all going to show that there is no substantial foundation for the exclusive claim set up by the Western Union Company.

In his sworn statement Mr. Bates makes a general answer to all the allegations in the several affidavits comprised in the plaintiff's case, and gives specific explanations and denials to many of them based on his long connection and experience with telegraph companies, and his personal knowledge of the history and practical operation of the duplex apparatus. It is held on behalf of the Baltimore & Ohio Company that the re-issue of the patent in 1882 was invalid, in that it was not a re-issue of an original patent, but the issuance of three new and separate patents covering nine claims, and including other inventions known to the art of telegraphy within the ten years intervening since the original patent was granted for one and only one invention; this broadened the claim so much as to make the last re-issue under the established rules utterly invalid. In addition to this legal point, the Baltimore & Ohio Company's expert testimony asserts that the use of the condenser as limited to one station was anticipated by Prof. Varley, of England, who employed the same thing precisely to submarine telegraphy.

Much reliance is placed on the specific testimony of Prof. Freeman, who was chief examiner of the Patent Office at Washington, when application was made for the last re-issue of the original patent, which was granted just prior to the decision of the Supreme Court of the United States, in the case of Miller *vs.* The Bridgeport Brass Company, wherein the court held conclusively that a re-issued patent which was broader than the original was invalid. When Stearns made his original application in 1872 he claimed the use of a condenser at one station only, but before the patent issued he canceled that claim and substituted the words "at each station." When the Western Union Company obtained the re issued patent in 1882, ten years later, they left out these words, and the Baltimore & Ohio now claim that by leaving out these three words the Western Union opened the door to a free use of the invention as Varley's combination of 1859 above referred to is precisely what is now used by the Baltimore & Ohio Company.

The case has been submitted and the decision reserved.

*** The Brooklyn commissioners have adopted the underground plan submitted by W. D. Sargent, general manager of the New York and New Jersey Telephone Company. The work will cost this company and the Western Union Telegraph Company (the wires of these two companies occupying the same conduit) at least $20,000. In the trench that will be dug is to be placed a wooden box capable of holding 1,000 wires. These will be massed in cables probably of 100 wires each. Space is to be reserved for the wires of the Fire and Police Departments (though the city authorities have not yet appropriated the money for putting them underground), the commissioners making that reservation one of the conditions of their approval. If the commissioners grant the two companies a permit to begin next week, contracts would have to be made for the lumber and the cables, and at least a month must then elapse before the work of opening the streets for the wires would begin.

*** Satisfactory trials of long distance telephony have recently been carried out in Hungary between the towns of Csorna, Gallya, and Hereny, a distance of 110.36 miles.

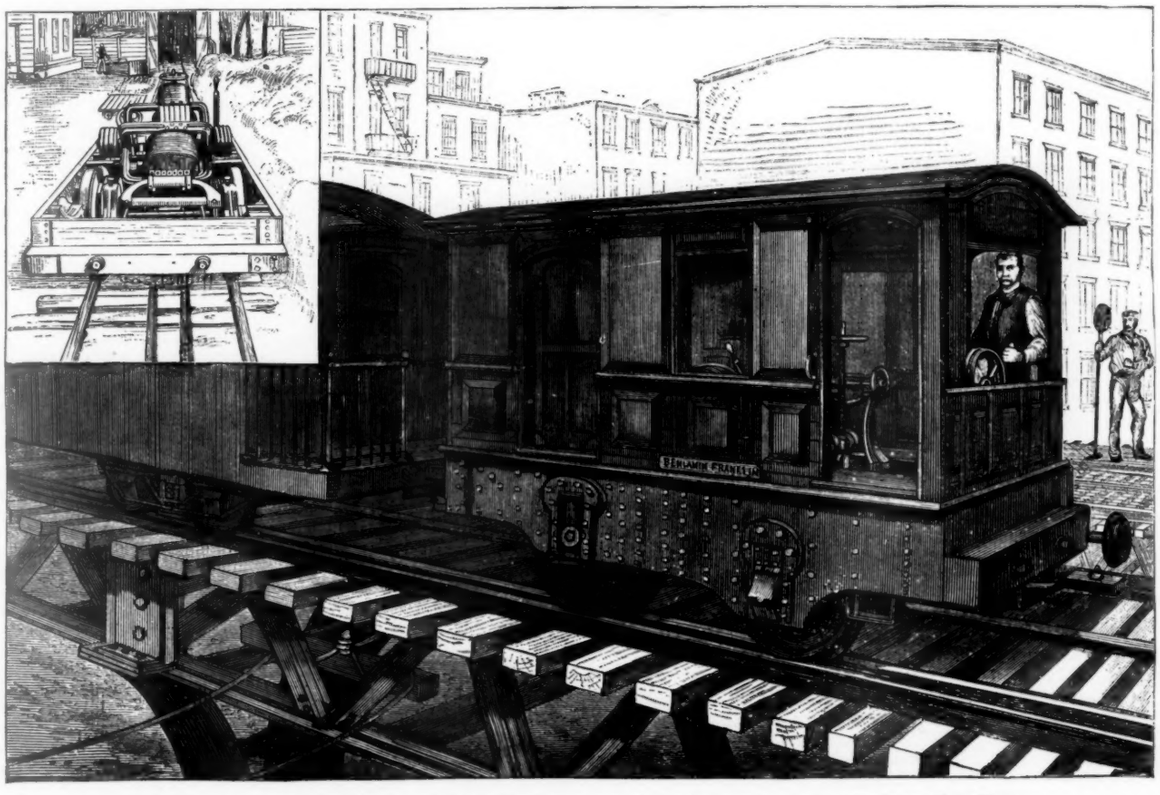
The Daft Electric Motor.

We give an illustration of the Daft Electric Motor, with which private experiments have been made within the last few days, on the Ninth avenue Elevated Railroad tracks, between Fourteenth and Fifty-ninth streets, this city. The question of the practicability and economy of substituting electricity for steam is one of much interest to the elevated roads, and the officials are carefully watching the work of Mr. Daft's invention during these trials. The electric circuit is made from the dynamo to the central rail, through the collector to the motor, thence to the wheels and rails, and back to the dynamo. This company have laid their third rail upon the Ninth avenue line, commencing at Fourteenth street. The rail is insulated by the Daft Patent Insulator, which prevents water from making a connection from rail to sleeper, thus insuring a good insulation. The road is further equipped by completing the electrical contacts at the joints of the outer rails. At the end of this line the company have located their central station. They have placed in position a large engine, with the necessary boilers and shafting. Two fifty-horse-power Daft dynamos are now in position, and later a third will be erected to relieve the others, in case of accident. The wires are carried from the station to the rails through the streets upon poles.

The connection with the middle rail is made by means of a heavy bronze wheel 14 inches in diameter. This being fastened to an arm, may be raised or lowered, thus allowing discontinuities in the central rail, of which there are several in the Ninth avenue line, to be safely passed. The wiring is all underneath the frame and is enclosed in wooden sheathing. The device for controlling the motor is placed at the end of the cab This is a device of sliding contacts worked by a handle similar to the throttle in the locomotive cab, which raises or lowers the resistance in the field-magnet circuit, thus varying the amount of current and consequently the strength of field and speed of motor. There is also a complete cut-out in circuit. The motor is thus under control; it being possible to run fast or slow. The motor may be stopped either by the cut-out, or by lifting the contact wheel. The system is further provided with an automatic cut-out which breaks the circuit when the current reaches a certain strength, at the same time ringing a bell at the central station, warning the engineer at the central station that there is trouble on the road.

The reversing-gear is simply four brushes connected by suitable links, so that a movement in one direction applies one pair of brushes, while a movement in the other applies the opposite pair. In the motor "Benjamin Franklin" the ordinary hand-brake is employed.

The public experiments are announced for an early day, at which time some opinion of the efficiency of this motor may be given. It is to be hoped that Mr. Daft will not neglect to have present at his public trials, men capable, in a technical and practical sense, of rendering a reliable and authoritative decision as to the merits of his invention.



TWO VIEWS OF THE DAFT MOTOR NOW BEING TESTED ON THE NINTH AVENUE ELEVATED RAILROAD, NEW YORK.

A Voltaic Cell with a Solid Electrolyte.

I believe that there has never hitherto been made a voltaic cell with a solid electrolyte which was capable of generating the smallest sensible current—at least at ordinary temperatures. Sir William Thomson found that when warm glass was placed between plates of zinc and copper, the existence of an electromotive force was indicated by an electrometer in connection with the metals, and Profs. Ayrton and Perry extended the observation to the cases of paraffin wax, gutta-percha, india-rubber and shellac. But it is needless to say that with electrolytes of such enormous resistance no current could be generated of sufficient strength to be detected by any galvanometer, however delicate. On June 27 I exhibited to the Physical Society a little cell consisting of plates of of silver and copper, between which was contained a mixture of one part of copper sulphide with five of sulphur. When this cell was connected with a reflecting galvanometer it produced a current by which the spot of light was at once deflected off the scale, copper being the positive pole. The electromotive force was found to be .07 volt, and the internal resistance 6,537 ohms. The current, therefore, though far more than merely sensible, was small. Attempts were made to reduce the internal resistance by diminishing the proportion of sulphur contained in the mixture, but it appeared that as the sulphur was diminished the electromotive force was also diminished, until, when there was no free sulphur at all, the cell failed to produce the smallest measurable current. It occurred to me that the sulphur owed its efficacy to the fact that it formed a film of silver plate by direct combination. I therefore made a cell thus: A thin layer of copper sulphide was spread upon a copper plate and compressed into a compact mass against a surface of polished steel. A layer of silver sulphide was then spread upon the copper sulphide, and the cell was completed by pressing a silver plate upon the silver sulphide. The current which this cell produced through the shunted galvanometer was considerably stronger than that generated by the cell first described; but still the result was not quite satisfactory, and there seemed to be indications of short-circuiting, which I thought might possibly be due to the penetration of particles of copper sulphide through the layer of silversulphide. The silver plate was therefore removed from the cell, and having been brushed over with a weak solution of sulphur in bisulphide of carbon, it was heated over a gas flame, and soon became covered with a uniform and continuous coating of sulphide. The heating was continued until all the free sulphur was evaporated. When the cell was reconstructed with this prepared plate, it produced a current of 6,800 micro-amperes through an external resistance of .2 ohm, and was able to deflect the pivoted needle of an ordinary coarse galvanometer. The dimensions of the cell are as follows: The copper and silver plates measure 2¼ inches by 2 inches; the thickness of the two layers of sulphide (strongly compressed) is about 1-20 in.; the E.M.F. is .053 volt, and the internal resistance is therefore about 7 ohms. This cell seems to be exactly analogous in its action to a Daniell cell in which plates of copper and zinc are immersed in solutions of copper sulphate and zinc sulphate. Silver is probably the best (or only) possible metal for the positive plate, but some other metal might, perhaps, be substituted for the copper with advantage.—*Shelford Bidwell, in Nature.*

Electric Fans.

"What is this?" asked a broker, as he sauntered into a Wall street banking house on Saturday and fixed his inquiring gaze on a curious little machine from which there came a subdued whirr and a current of air. Then he put out his hand to investigate. There was a subdued snap, and he drew it back with three fingers cut half off. While the clerks were binding up his wounds previous to starting him off for the family doctor, they explained that the thing which he saw was an electro-motor, while the part that he felt, but hadn't seen, was an eighteen-inch fan, making 2,200 revolutions a minute. The broker went home with his curiosity satisfied, and the clerks decorated the machine with a huge placard, "Hands off!" There are now over fifty of these fans in use in the downtown district alone, the stock exchange and most of the leading banking houses having them. The rent for a machine is $15 a summer, and they are run by the current which supplies the lamps at night, a fan and a lamp requiring the same amount of power, the cost of either being 1½ cents per hour. The fans can also be bought outright. A large one will create a current of air that can be felt at a distance of fifty feet. They are made of two kinds of material, metal and fiber. The latter is not as durable, but it isn't so hard on the fingers of the inquisitive spectator.

*** The Kennebec *Journal* says that the employes of the telephone company in Augusta were engaged in dismantling telephones Tuesday. About twenty were removed at the request of subscribers, and it is thought that about forty will come out in all. Some who signed the petition asking for the removing of their telephones have taken back tracks, and ordered that the instruments remain. The less the number of instruments, the less the value of the telephone service; and some subscribers, who would otherwise continue, are ordering out their instruments, thinking an impairment of the service will result from the removal of so many instruments. There are many, however, who find the telephone a necessity and will not do without it, let the cost be what it may. In the case of grocerymen and the traders generally, if one retains his telephone, it influences others not to dispense with their wires, as the telephone gives an advantage in taking orders. We have no doubt but that all the discontinued subscribers will soon return to the telephone, and the result will be an increase instead of a decrease.

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Address all communications and make all checks and P. O. orders payable to order of ELECTRICAL REVIEW P. O. Box 3329, New York

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Mr. J. Viennot, 150 South Fourth Street, Philadelphia, is our accredited representative for Pennsylvania.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill. will represent the REVIEW in the West.

Messrs. Wm. Dawson & Sons, 121 Cannon Street. London, England, are our representatives for Great Britain.

NEW YORK, SEPTEMBER 12, 1885.

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Messrs. Edison and Gilliland are reported to have formed an alliance, and will move to Florida, open a laboratory, and proceed to investigate all that is known and unknown concerning electricity. They will make a strong team.

The editorial we publish on our second page, taken from the *Scientific American*, is an indication of the interest taken by the leading technical journals in the National Electric Light Association. It should be read by all who are interested in the success of the association and in electric lighting in general.

The Telegraphic Time Company, of this city, have just issued an attractive "Prospectus," which is profusely illustrated with cuts of their electric time pieces. The advantages of electric time, and the methods of furnishing the system are plainly stated in the prospectus.

The U. S. Signal Service has been for some time considering the advisability of connecting the lighthouses on Martha's Vineyard and Nantucket with the mainland by cable, and since their decision to take that step the manufacturers and dealers in that kind of goods have been doing some close figuring on the specifications furnished by the Government. The contract, which has just been awarded to the Western Electric Company, will require about 24 miles of submarine cable.

THE TELEPHONE CONVENTION.

The seventh annual meeting of the National Telephone Exchange Association, has been in session in Providence during the past week. A full report of the proceedings will be found in our news columns. The convention was welcomed in a felicitous and appropriate speech by ex-Gov. Howard, President of the Rhode Island Telephone Company, which called forth a response from the President of the Association, Morris F. Tyler, Esq., of New Haven. With these preliminaries settled, the convention got down to work, listened to reports from several committees, and discussed them. The presentation of such reports, and their thorough discussion, affording an opportunity for a free interchange of ideas, cannot but result in good, especially as all proceedings are to be put into print for subsequent perusal. We note with pleasure that the association has decided that its Secretary shall be sufficiently compensated to warrant his giving a liberal share of his time and effort to its service, chiefly in the direction of obtaining statistical and other information likely to be of value. We commend to our readers a very careful perusal of our report of the convention's proceedings in this issue, as from it, better than from anything we can say, they will derive an adequate idea of its importance. It is needless to say that the resident telephone men left nothing to be desired in the way of hospitality. Rhode Island is small, but very large-hearted.

THE "VILLAGE SYSTEM" OF TELEPHONY.

It is a question of no little moment with telephone companies, What shall be done with small exchanges?

All know, from experience, that it does not pay, at least, directly, to hire an operator and maintain an exchange of less than fifty subscribers at prices people in village places can afford to pay. On the other hand the small exchanges are, in a sense, feeders to larger exchanges, making the telephone in cities still more necessary to parties carrying on business with suburban towns.

The extra territorial business is also largely made up of connections from small to larger exchanges.

To meet the want in these small exchanges, Mr. Gilliland, of the American Bell Co., has invented and developed what is called the "Village System," and by great exertion on his part, and also on the part of General Manager Keller and Electrician I. H. Farnham of the New England Co., the work of constructing instruments and establishing a system, has been pushed to completion in season for the examination of the Telephone Convention.

The system now in operation is located at the wealthy little village of Leicester, Mass., six miles west of the city of Worcester. The system now covers twelve subscribers, and may be extended to any number less than fifty.

The plan in general is to run a series of lines through the town on poles or otherwise (poles are wholly used in this case), and leading all of the lines by means of a small cable into each subscriber's place, and providing him with an instrument by which he can easily connect himself at pleasure with any of the lines of the series, thereby having access to any subscriber without the intervention of an operator or central office.

It's a fact thoroughly impressed on telephone men, that instruments for use of the general public must be very simple, strong and easily operated, or they will inevitably be improperly worked, left in a wrong condition or broken. Mr. Gilliland has very happily supplied the instrument to fill this necessity. While there is, of course, considerable of an operation for the instrument to perform, it can be operated by the dullest subscriber, and cannot be left so as to interfere with other subscribers when not in use.

The instrument includes crank magneto, battery box and special switch, all combined on a back board. The woodwork is of cherry, and the top of the instrument forms a convenient desk. The present instruments are intended for eight lines, or any number less.

In front of the desk is placed eight knobs lettered from A to H. The subscriber's bell magnet always remains in its particular line, but the telephone, transmitter and generator are connected with any line by simply pushing in the proper knob. In this way the subscriber is enabled to call either subscriber on any of the lines, and converse direct. The two lines are not *connected*, but the instrument is looped into the desired line. Now, some of the beauties of the mechanical construction of the new instrument are :

1st. If a subscriber should for any reason push in a second knob, the first one will snap out ; in other words, but one knob can be pushed in at a time, for when another is pressed the first returns to its normal position.

2d. When the telephone is replaced on the hook the knob comes out so that the subscriber's instrument cannot be left in circuit. Placing the telephone on the hook also opens the local battery circuit.

An incidental advantage to the subscriber is seen in the fact that when he may be talking on another line he may be *called* on his own line.

In the switch the springs are arranged in pairs and connected one with the incoming and the mate with the outgoing wire ; normally the springs rest on one and the same metal plate, thus allowing the circuit to pass through.

When, however, the knob is pushed in this plate is carried back out of range, and instead of it, two smaller plates come under the springs ; these small plates forming terminals of the subscriber's instruments (excepting his bell). The arrangement whereby but one button can be pressed at a time is very simple, and sure to act properly.

It is found convenient to run open lines on poles, and enter subscriber's places by short cables from nearest pole. Mr. Gilliland has furnished a special arm for use where cable is to be connected by means of this arm. The wires can be "dead ended" without strain, and at the same time the insulator connects the line wire with insulated wires leading through the arm to the cable box ; the box is made of cast iron, small and neat and closes water-tight by rubber packing. This is also designed especially for the village system, which, altogether is very complete.

SUBWAY PERPLEXITIES.

The Subway Commission is at work in earnest. Its rooms on Twenty-third street are the resort of a host of persons interested in an endless variety of underground systems, and the tables, chairs and floors are littered with models and samples. Of these, the best that can be said is that they are all interesting, and that many are ingenious; but it must be added that not one of them, as yet, has shown that it has the qualities essential to success. As the commission interprets the law, the absolute prerequisite is an *inclusive system*—one which will provide for all descriptions of electric wires, carrying all varieties of currents, without the possibility of interference the one with the other. Out of the great number of systems, good, bad and indifferent, which have been and will be presented for their consideration, the commission feels called upon to select one which will fulfill these necessary requirements, and, having made such selection, it must adopt it and cause it to be constructed.

The members of the commission are all new to the underground problem, and it is no discredit to them to say that they are, as yet, uninstructed concerning it. They are listening patiently and attentively to the claims and explanations of rival inventors, but they have to bear in mind that, in every case, self-interest lies at the bottom of all descriptions and assertions. The fact is to be borne in mind that nowhere in the world is there in successful operation the thing which the commission feels called upon either to find or to "devise or cause to be devised"—*i. e.*, an inclusive system which will successfully carry all manner and kinds of currents, with provision for use of any one of them at any point, and this view of the case very naturally makes the commission pause, and leads them to feel that everything must be done with extreme deliberation and caution. The expense, delay and trouble which would result from any mistake growing out of hasty action, are alone sufficient to deter the commission from taking any decisive steps until both the electrical and commercial success of the proposed "system" is assured beyond peradventure.

There is but one way in which this assurance can be got. The representatives of the several schemes assert that their respective "systems" are equal to all requirements. It is very certain that the majority of them are mistaken, honestly, no doubt, but nevertheless, mistaken. By calling upon disinterested experts for information and advice, it is easy for the commission to determine which of the "systems" give promise of standing the test of actual service, for this is too important and serious a matter to be decided upon the basis either of theory or of laboratory experiment. It is claimed for each of the rival underground "systems" that it, and it alone, can fill the bill. But talk is not proof.

Let the commission, when it has made a selection, call upon the parties to put down two or three miles of their "system," exactly as they purpose building it, equip it with all manner of wires, and to test it with all these in use at once during a reasonable length of time; final adoption to be dependent upon its successful operation. Such an experimental piece might be put into one of the principal streets so that it would come into actual use should the result warrant its adoption. Less than this the commission cannot afford to ask, for a very grave responsibility rests upon them, one whose importance they fully appreciate.

TELEPHONE CONVENTION NOTES.

The exhibition made by the American Electrical Works, of Providence was particularly fine and interesting, and consisted of everything that the telephone man could possibly need in his work. Messrs. Phillips, Sawyer and Angell, of this company, were constantly present, and aided very materially in making the visitors feel at home.

The ride down the bay in the steamer Philadelphia, furnished free to the visitors, with the compliments of the Providence Telephone Company, was a very successful and enjoyable event. The Providence Company proved themselves royal entertainers on this occasion, and set out a collation that will ever be remembered by the "hungry and thirsty" telephone men.

The Western Electric Company were present in strong force, and exhibited in parlor 5 samples of the Patterson cable, chiefly as it is used in underground work. The Dorsett conduit, the Washington method and the Brooklyn method were all shown. The company is represented by Vice-President Barton, Manager H. Thayer, Frank Harrington and C. A. Rolfe.

The Okonite Company, represented by Mr. Candee, have a good exhibit of their insulated wires and cables. Their exhibit was examined by many of the interested members present.

In the parlor occupied by the American Bell Telephone Company one of Hunning's loud-speaking telephones was placed, and connected with the New York and Boston line, and many availed themselves of the opportunity to talk to those cities. The line worked very satisfactorily.

E. Baker Welch, of Cambridge, Mass., exhibited an individual call system, claiming it to be a perfect system for telephone secret talking.

The Bridgeport Brass Company, and the Standard Electric Company, had pleasant headquarters, open to all during the convention, and where everyone was handsomely entertained.

The suite of rooms occupied by the ELECTRICAL REVIEW staff was honored by visits from all the telephone people and manufacturers present.

The talk of discontinuing the convention, which was heard during the early hours, was soon forgotten in the enthusiasm of greetings and discussions which followed.

Gen. Barney's steamboat party from New York, arrived in good style on time, and voted Mr. Barney a splendid manager.

National Telephone Exchange Association.

(Concluded from page 9.)

subject of underground conduits was treated upon at some length, and in a very clear and interesting manner. He rather favored a system which would permit the removal and manipulation of the conductors after the conduit was laid. Good joints and good workmanship were required in any system adopted. In Chicago, the experience with the wooden-box conduit demonstrated the necessity for its reinforcement with some other material. Mr. Paterson thought that there was no reasonable doubt that the underground system could be made a success as regarding any electrical difficulties, but the aerial lines should be replaced gradually. As to the matter of cost of underground wires, of course, only when there were a large number of conductors running in one direction, would it compare at all favorably with that of aerial lines; and the idea of putting all the wires of a city under ground at once was utterly impracticable and absurd. It could only be done gradually. The most complete work, so far, he said, had not been done under compulsion, but from preference. This simply showed the spirit of the companies. Valuable information was given as to the number of wires which it had proved feasible to operate in underground cables. Mr. Paterson received the thanks of the association for his valuable paper.

Mr. Durant then took the chair.

President Fay presented an extremely interesting address on the subject of "The Use of Cables in Cities." No cables, he stated, either overhead or underground, for any reasonable distance or time, had failed, and we have cables of two and three miles in length. It was a difficult matter to decide which particular make was the best; it would require a much longer experience than we have had. There had been much vicious legislation on the subject of underground and aerial lines, and he thought the best safeguard would be in the education of the public in the matter, thus insuring intelligent legislation. He then spoke very forcibly of the irresponsible and mercenary spirit in which the subject had been handled by many of our legislators. The many objections and inconveniences of a complete underground system in cities were very clearly described, not the least of which was the continual tearing up of the streets which it would entail. The speaker proposed a system of house top cable wiring, carrying the trunk lines to the centers of blocks in rear, and from there distributing local circuits. To be sure it would retain the eyesore, but to how small an extent! He had replaced 2,400 wires by 30 cables. In his opinion there would be less objection to this plan from both sides, than to any other. He hoped that some such plan would be adopted.

Mr. Fay's paper received the thanks of the meeting, and was placed on the minutes.

Mr. Lockwood made a few remarks on the subject of the previous paper, and offered and read a copy of a report of the committee of the British House of Commons appointed to examine into the problem of the stringing of overhead lines, &c., in which they recommend much less stringent laws and greater license in the matter. The remark of Mr. W. H. Preece was adverted to, that there were more telephone subscribers in New York and its vicinity, than in the whole of the United Kingdom. The paper was accepted with thanks.

Mr. Sargent wished to know whether any legislative action has yet been based upon this report.

Mr. Lockwood stated that no action had been taken, as Parliament had been prorogued shortly after the report had been presented which was in May, 1885.

Mr. Sargent presented a statement of the operations of his company in Brooklyn, in the matter of underground wires, acting under the Daly Bill as amended. He stated that they had removed 200 poles. He thought that the committee had shown a very proper spirit in the matter. They had approved their plans for 1½ mile, and he thought that it would be adopted by the commission for all lines. He expected to be able to clear Fulton street of all its poles in a short time.

They had been granted permission to temporarily use the roofs of buildings belonging to the city for distributing purposes, such as school houses, police stations, etc., but they were expected to do away with poles as soon as possible.

Messrs. Sargent, Fay and others, discussed the subject quite fully.

The next business in order was a paper by General Sherwin, auditor of the American Bell Telephone Company, on the "Best Form of Keeping Accounts," which proved highly entertaining and instructive, and the thanks of the association were given. Its discussion followed, and was entered into by Messrs. Sargent, Durant, Fay, Bailey, Carson, Hall and Metzger.

At 5.15 o'clock an adjournment was taken.

The association met on Thursday morning at 10 o'clock, and several interesting papers were read and discussed, when the meeting adjourned, to meet in St. Louis in September of next year.

The balance of the week was taken up by enjoyment of the various invitations to visit the places of interest in and about Providence. On Friday Leicester, Mass., was visited to examine the village system, and on Saturday the association was treated to one of Mr. Phillips' incomparable clam-bakes.

GENERAL WESTERN NEWS.

The Director-General of Telegraphs in Brazil recently furnished an exhaustive report on the condition of the lines in that country. It would seem that the surroundings and adverse circumstances have been anything but pleasant to contemplate from the standpoint of constructors and repairers. The lines are seldom built along the highways because of the risk of damage from the cumbrous ox-carts of the State and of the heavily-laden beasts of burden which traverse the country roads without conductors. To avoid these, it is necessary to construct routes through old forests, thickets and marshes, across rivers subject to sweeping freshets, and over arms of the sea. The country is often drenched with fogs, which are quite potent for the destruction of both poles and wires, and the dry season, which sometimes continues from six to eight months, checks and splits the poles, which are sometimes covered with fungoid growth.

The sudden decrease in temperature after sunset breaks the wires and cracks the porcelain insulators. Luxurious vegetation along the wild routes gives abundant employment for the ax and pruning hooks of the linemen.

Animals undermine the poles, and, if not prevented, eventually cause these to topple over. The most mischievous are a species of marten and a native skunk. Monkeys climb the poles and play circus on the wires. The birds, too, take a hand in the show. Some varieties of the feathered tribe build mud nests on the summits of the poles, and stiffen these with branches, herbs and feathers. Others roost upon the wires, while birds which fly by night or in the dim twilight tangle or break the conductors. Bees, wasps and hornets abound, and are ever ready to welcome intruders, while some varieties of these nest in the insulators, their dwelling being composed of tough clay, guarded by the business end of the proprietors.

Huge termites and other ants also infest the poles, often completely covering the insulators with their mud nests, which are so firm as to sometimes require a hatchet for their removal. One form of the termite fills the pole with burrowing galleries, and in a comparatively short time leaves it but a shell.

Brazil has myriads of spiders. These, numbering hundreds of species, are always on hand. A huge "crossbearer," black, with ruby-red spots, builds in a social sort of way. Hundreds of individuals congregate to form a spider city, and build their nests a few inches apart, fixing their guy-lines to the wires. In this way they cover the trees, bushes, telegraph posts and wires so completely as almost to hide them from sight. When these are well soaked by the heavy dews, or the waters of the rainy season, the average Brazilian operator either crosses himself piously or talks hard. M. le Conseiller d'Etat, Baron de Capanema, will hardly be envied by any of the telegraph kings of North America.

Somebody proposed a while ago to telephone across the ocean, and another, who is an expert at mathematics, calculated the necessary dimensions of a conductor for the purpose, the outcome of which he announced to be a copper wire of 17 feet diameter, covered with the necessary insulation of gutta-percha 5½ feet thick, which, with the armor, would be a total of about 28 feet! It has been suggested that perhaps it would be cheaper to build a bridge, or perhaps a tunnel.

A telephone joke is told of a party who called for Mr. X——, of the firm of X—— & Z——. Now Mr. X—— has an impediment in his speech, in short, stutters badly. The telephone that morning worked hard, and the boy could not get the name asked for. Finally, in despair, the gentleman said, "Oh! send me that man that talks with a broken cord." The boy saw the joke, and the unfortunate stutterer was called to the instrument, but in not the best of humor.

The horrors consequent upon the use of electric wires must be kept before the people. To read a recent article in a New York journal, the novice might possibly suppose that these engines of the evil one are liable to enter our dwellings and do most any mischievous thing; strangle us after the manner of anacondas; burn us like witches under old puritanic ruling; shock us to death without giving time for the "half-pint pannikin of prayer" the Hon. Judge Lynch usually accords to his victims. Why, the thing should be stopped at once. No longer ago than a year, according to this alarmist, and as near as four thousand miles of us, a man of twenty-one years of age put both hands on the terminals of a running dynamo, and the abominable current killed him. Again, almost one year ago, in another part of the same country, the engineer-in-charge put himself in the direct circuit at a lamp which had gone out, and he, too, died. Somehow, this sort of sensational padding for a newspaper reminds one of an old story which comes from a goody-goody book long out of print, called "Simple Tales for Children, with Morals" Whether the morals were the property of the tales or of the children was always questionable. However, to the story:

"Little Harry Brown had a leaden cannon, and he loaded it with some powder from his father's flask, when he touched it off he stood in front of the cannon and was badly burned. Powder is dangerous, and should only be used by persons who know how. Do you not think Harry a ve-ry bad boy?"

The story loses half its horror for want of the illustration heading the fearful tale, which represented a Krupp gun in the act of discharge, Harry in a sort of third alarm blaze, and the agonized mother with a tailed-out procession of little ones running like a volunteer fire department to the seat of a village conflagration.

The yearly exhibit of the Inter-State Industrial Exposition here, opened on the 2d instant. The show, of course, was incomplete at the start, but the space is said to be all taken, and by the end of the week all will be well under way. The electric-light people have, for some reason, not gone generally into the building with their exhibits this year as formerly. The Bain company appears to have a clean sweep of the entire exhibition. Forty of their lights illuminate the art gallery, and twenty are distributed through the building for general illumination. In addition to these, some forty more will be placed in and around the booths of exhibitors.

The improved methods of wire stringing within the building this year, have very materially lessened the work of inspection, as every lamp is hung upon insulators, as well as the wire, and the calcimine fiend has had no opportunity of grounding the latter; while the humid atmosphere, saturated by escaped steam, and the spray from the fountain will work no mischief by wetting the cords by which the lamps are suspended from the roof truss-rods. Heretofore both these causes have seriously interfered with the high insulation required by the authorities.

The VanDepoele motor, in several applications, is a prominent exhibit of a mysterious character. Attached to these are pulleys imparting motion to huge fans in the gallery of the building, as well as on the floor, and a sewing machine exhibit will be actuated by the same means.

The street-corner shocking machine bearing the legend: "Electricity is Life—5 Cents," has not yet made its appearance, but will probably wheel into line in a few days—at least they most always generally do at such places.

So far the electrical part of the show is meager, but high hopes are entertained for the future. We shall see.

The Standard Underground Cable Company, Pittsburgh, are drawing in Waring cables, on the north side for the Chicago Telephone Company, under the supervision of Mr. Hayward. In an east and west line these will run from the company's exchange at the corner of Clark and La Salle to State street, three in the one direction, and to Wells—eight—in the other. The cables are eleven in number, as above. At Wells street these rise to a line of poles. Midway between La Salle and Wells the line divides, a portion running south to Michigan street, along this to La Salle, and thence to the tunnel, through which they will connect the South Division. This company have recently laid a cable for the Philadelphia Gas Company from Pittsburgh cross the Allegheny river to Sharpsburg, some 2,000 to 2,500 feet in length, for telephonic purposes.

The Western Electric Company have recently removed their central electric-light plant to the Taylor building on Monroe, from the inconvenient location heretofore occupied by them on Dearborn street. The former locality was in every way uncomfortable and crowded. The new quarters are airy, convenient, and, in every way, far preferable. From this point their lines will run to Randolph and Clark streets, and cover the ground north and east of that point to Dearborn. Mr. Stewart, who has the installation in charge, has just brought out a stationary fixture for the fronts of buildings, which, where it can be used, does excellent service in getting rid of the abominable clothes line loops so common in outside arc lighting.

The tendency is toward permanency in the placing of such lamps, and posts are strongly recommended in lieu of hanging lamps. The city grants permits to place iron posts at the curb-stone line, provided these are of the standard pattern, and the wires are led beneath the pavement to and through the post to the lamp, in cables. The advantages of this form of outside light are as apparent as numerous. They place the wires entirely out of the way; illuminate the street and the building as well—generally better than when placed upon it; and they present a neat, artistic appearance.

The Badger Company have also inaugurated some changes in their lines, and are making permanent fixtures when these are practicable.

Mr. Sperry lately put up an experimental permanent fixture consisting of a gas pipe through which the wires are carried in cable form, peculiarly insulated at the terminals, which is doing good service. Out of all these endeavors it is to be hoped and believed we may soon do away with the ungainly loops which have heretofore characterized all outside installations.

Telephone stock values are thus reported by Col. Lynch's exchange:

Central Union	.55 @	.57
Michigan	.68 @	.70
Iowa Union	.18 @	.20
R. M. Bell	.50 @	.55
Great Southern	.50 @	.55
Chicago	$375.00 @	$400.00

CHICAGO, Sept. 8, 1885.

Mr. Van Depoele telegraphs from Toronto that he started the electric railway there successfully on Wednesday last, using the Van Depoele Motor.

TELEGRAPHIC

.... Another strike is rumored among the telegraph operators of this city.

.... A quarterly dividend of 1½ per cent. is announced for the Western Union Telegraph Company, payable October 1st.

.... It appears to be certain that as a result of the telegraph conference the great cable companies will reduce their tariffs 20 per cent.

.... According to a Texas paper, the corn stalks in that State are so tall and large that they are being used as telegraph poles by the Baltimore and Ohio Company.

.... At Galveston, Texas, the Western Union operators are on strike because the hours of labor in vogue six months ago will not be restored by the company.

.... It is stated that the breaking off of the negotiation between the Baltimore & Ohio and Western Union telegraph companies is likely to result before long in a fight between the cable companies.

.... The steamer City of Chester, which arrived at Queenstown the other day, reports that on Thursday last she passed a telegraph ship working on a submarine cable. The question is, whose cable is broken?

.... The Western Union and B. & O. telegraph companies are now in litigation over the duplex apparatus for which the former company claims the exclusive patent. The case is being heard by Judge Wallace, of the U. S. District Court.

.... Female telegraph operators in Germany receive $240 a year, and no vacation. When one remembers the length of the words they manufacture in the Vaterland, one can have some idea of the hardships under which the female telegraph operator suffers in King William's domain.

.... The Averell Insulating Conduit Company have closed up the work of placing the wires connecting the Baltimore and Ohio Railroad Depot with the office of the latter near Willard's, on Pennsylvania avenue, Washington, D. C. The wires on this connection are reported to be working well.

.... The Baltimore & Ohio Telegraph Company have just completed their lines to Bridgeport, Conn., and Harrisburgh, Pa. The lines to Lancaster will be finished in a few days. The contract has been let for extending their wires to Little Rock and the Hot Springs, Ark., and communication with those points will be complete within a few weeks.

.... The Baltimore and Ohio Telegraph Company on Saturday completed the stringing of a third wire from Baltimore to York, Pa. The wires of the company will be connected with Lancaster to-day. It is stated that the lines will be spread extensively over Pennsylvania territory, and an incorporation under the laws of that State, with an organization in some respects separate from the parent company, is contemplated.

.... According to news received from Ischl, the Empress of Austria has had a somewhat narrow escape from what might have been a serious calamity. At 5 o'clock on the morning of the 13th, which is about the hour when the Empress takes her morning bath, her bath-room was struck by lightning, the electric fluid knocking down Her Majesty's attendant, who was preparing the bath, and violently striking the parquet flooring.

.... Intelligence from Victoria reports that the committee of the Melbourne Chamber of Commerce had decided to request the Postmaster-General to endeavor to get the Governments of the various colonies to cooperate with him in trying to induce the Eastern Extension Company to lower the rate charged for telegrams between Australia and New Zealand. They had also decided to seek the co-operation of the Chambers of Commerce in New South Wales, South Australia, New Zealand, and other colonies in urging the respective Governments to take action in the matter.

Subterranean Electric Wires, and a Conduit for Practical Use. Some Comparisons.

Editors of the Electrical Review:

The present general methods of underground electric conduits, and those hitherto experimented with by telegraph, telephone and electric-light companies, have been faulty in construction, poor in insulation, unadapted for different companies to use in common, not accessible for house to house connection and exceedingly costly; and it would seem that the electricians of the different corporations took a delight in recommending to the directors some "iron-bound" system that would fail in a short time, thus giving them an opportunity to report the failure before some legislative committee. Some of them going so far as to say that to work electric wires beneath the ground was an utter impossibility. The electrical subway commissioners in this city have already received communications from several companies alleging the impracticability of the subway scheme. A letter from the president of the Brush Electric Light Company informed the commissioners that no practicable method had been found as yet by which his company could place their wires beneath the ground, and that they had experimented with the best of underground conduits.

Mr. Edison insulates his low-current underground conductors somewhat heavier than this, but the circuits in this system are continually grounding.

It is necessary, in order to construct a perfect and durable underground conduit, that the entire structure should be one solid, impermeable mass, no hollow box or tubing will answer, not a drop of moisture should penetrate the exterior covering and the compounds used should be decay-proof, waterproof, heat-proof and anti-inductive. No insulation should be used that will corrode the conductors. The insulating material should be loose and porous, while the conductors should be well separated. This cannot be accomplished by using cables. When properly laid, cables will work well, but something far better than closely woven cable cores must be used for underground conductors, especially where a mass of wires is needed. The wires must be placed in their cells and lanes permanent and solid. They must be subjected to no strain. The sections of the conduit should be entirely finished before leaving the factory. Manholes, hollow boxes and tubing should be avoided, for sooner or later they become sewers and water conveyers and as soon as underground wires are dampened the insulation ceases. These hollow structures are also a source of danger as they readily fill with gas and cause explosions, hurling the man hole covers high in the air, and a case is known where the entire conduit for blocks was filled with a flaming fire which melted the insulation, immediately grounding every circuit.

We hear a great deal about the immense cost of an underground plant. The cost depends largely upon how it is done. There are systems embracing expensive insulations that would cost several millions to adopt.

Dr. W. W. Jacques, the electrician to the Bell Telephone Company, in his paper to *Science*, says:

"Suppose we have a large city, with a telegraph office near the center, and that it is desired to carry a hundred wires to the city limits, say three miles distant. Let us suppose that the wires for the first mile rest on house tops and for the remainder of the distance on poles. The cost will be:

35 roof fixtures at $45	$1,575
80 poles, with arms, etc., at $65	5,200
300 miles No. 9 wire at $16	4,800
Stringing 300 miles wire at $8	2,400
Total	$13,975

Underground cost would be:

6 miles (50 conductor) No. 17 lead-covered cable at $3,000	$18,000
3 miles trenching, troughing, laying and refilling at $2,000	6,000
Total	$24,000

Taking Dr. Jacques' estimate and comparison as a correct one, and I think it is, I will compare the relative cost of the Pennock underground system over the same distance.

The cost for an overhead telegraph line for 3 miles (Dr. Jacques' figures)	$13,975

Pennock underground telegraph conduit, complete. Cost would be:

3 miles (100 insulated conductors 17 copper wire). 3 miles at $3,000	$9,000
3 miles trenching, laying and refilling, at $1,500	4,500
Total	$13,500

One of the claims for the Pennock conduit is that it is cheaper than a pole line. Dr. Jacques also examined some lead-incased gutta-percha and india-rubber underground cables belonging to the French government, that had been in use for 30 years and found them in good condition.

In the *Electrical Engineer* for May, Mr. Hamilton, the electrician of the Western Union, puts the cost of laying 60 conductors from 195 Broadway to Pier 18—2,200 feet—as follows:

4,063 feet iron pipe, at 20c. per foot	$812.00
Coating 130 pipes, at 3c	37.53
Laying two 1,850 feet parallel 3,700 feet of pipe, two pipes in trench, at 22½c	832.50
Setting and cutting two flush boxes (test boxes)	72.00
Laying and furnishing stone for 60 yards Belgian pavement, at $2.25	135.00
Elbows, Ironwork, etc, at cable house	50.85
Extra labor, etc., at cable house	60.50
Cable house at Pier 18 R. R.	160 25
Two cables (30 wires each) of 2,130 feet each	3,424 15
Labor—drawing cables in	40.95
Total	$5,625.73
Repairs caused by repeated failures	2.000.00
Grand total	$7,625.73

The Pennock system, over same route, would cost:

2,130 feet of underground conduit, complete (60 conductors)	$1,500.00
Trenching and laying, etc	832.50
Cable house	160.25
	$2,492.75

Thomas A. Edison says that $100,000 will put down 75 per cent. of the Western Union wires. I agree with Mr. Edison, but not if they use the systems described by Mr. Hamilton in the *Electrical Engineer*.

GEORGE B. PENNOCK,
Electrical Engineer.

The "Police Telegraph" Foreshadowed a Century Ago.

Editors of the Electrical Review:

It may be of interest to electricians to know that the instrument known as the "Police Telegraph" was foreshadowed more than a century ago. In No. 241 of the *Spectator*, written by Addison, may be found an almost exact description of that instrument. The article itself is devoted to the different expedients which may be adopted by lovers for alleviating the pangs of separation—such as at certain hours agreed upon to offer up prayers for each other, etc., and then it follows:

"Strada, in one of his prolusions, (Pro. 6) gives an account of a chimerical correspondence between two friends by the help of a *loadstone*, which has such virtue in it that if it touched two several needles, when one of the needles so touched began to move, the other, though at ever so great a distance, moved at the same time and in the same manner. He tells us that the two friends, being each of them possessed of one of these needles, made a kind of dial-plate, inscribing it with the four-and twenty letters, in the same manner as the hours of the day are marked upon the ordinary dial plate. They then fixed one of the needles on each of the plates in such a manner that it could be moved without impediment, so as to touch any of the four-and-twenty letters. Upon their separating from one another into distant countries, they agreed to withdraw themselves punctually into their several closets at a certain hour of the day, and to converse with one another by means of the invention. * * * * * * * *

"If he had a mind to write anything to his friend, he directed his needle to every letter that formed the words which he had occasion for, making a pause at the end of every word or sentence, to avoid confusion. The friend in the meanwhile, saw his own sympathetic needle moving itself to every letter which that of his correspondent pointed at. By this means they talked together across a whole continent, and conveyed their thoughts to one another in an instant, over cities or mountains, seas or deserts."

To say the least, this foreshadowing of a modern and well-known electrical instrument is remarkable, and as such deserves to be classed with the verification of Dean Swift's assertion (in Gulliver's Travels) that the planet Mars had a moon. W. L. B.

Richmond, Va., Sept. 5th, 1885.

Telegraph Operators' Salaries.

She was a pale, delicate-looking woman, and her nose terminated in a knob, but the marvelous rapidity with which she fingered the key of her instrument denoted anything but ill-health. It kept up an incessant klick-klick-klickety-click, and she was putting down figures so fast it was hard to follow the movements of her ivory-tipped pencil. The superintendent pointed her out admiringly.

"The fastest railroad operator in the office!" he said.

"What is the difference between a railroad operator and any other kind of an operator?" was asked.

"A railroad operator," he replied, "in telegraphic parlance, is one who dispatches trains and train dispatches. It involves mostly figures, and consists principally in putting the same thing down day after day. A commercial operator is one who sends ordinary messages of every kind. There are five principal kinds of operators. Besides the two I have mentioned, there are cable operators, who handle their dispatches generally in the form of codes, signals or ciphers; stock operators, who work in exchanges, banks and brokers' offices, and who have an elaborate and peculiar code of figures; and press operators, who transmit the dispatches of the various associated presses. Each of these classes of operators is entirely distinct in methods and training from the others, and it's not often that one is equally proficient in any two of them. The finest operators are those who handle the Associated Press matter. Few of them receive less then $100 per month, and many of them get $150 per month. The cable operators receive from $90 to $125 per month, the stock operators from $80 to $130 per month, the commercial operators from $40 to $90 per month, and the railroad operators from $50 to $90 per month."

"How fast can an expert operator receive?"

"The most expert operators in the country cannot receive more than 45 words a minute. The fastest receiving on record is 48 words per minute. This does not indicate that he could not read faster from the wire, but it is all he can take down on paper. The best record for sending is 51 words a minute, and they were taken down in short-hand. This was kept up for half-an-hour. There is as much difference between operators as there is between babies. Some can send faster than they can receive—others can receive faster than they can send. It is generally considered more difficult to receive than it is to send. Every operator handles the keys differently, and experienced operators can tell every man on their circuit as soon as he touches the key, simply by the way he makes his letters. Operators are born and not made. It usually requires six months in practice before a person can handle a wire at all, but to secure proficiency requires at least five years of constant handling of the wires.

"Telegraphing is a hard business and is underpaid. Expert commercial operators are often required to send 400 messages dur-

ing working hours, and the average is 200 per day. The Associated Press operators usually write right straight along, under full pressure, from 5 P. M. till midnight. Some of them do not drop the pen from their hands during that time."

More Telephone Poetry.—A Reply from the Telephone Girl.

THE SWITCHED-OFF SUBSCRIBER.

"Talk, talk, talk,
Till my brain is in a whirl;
And I would that my tongue could utter,
My thoughts to that telephone girl.

O, well that she's safe and sound,
In the Central Office there;
O, well that she's out of reach,
In her wire-environed lair.

Yet my wild 'Hello' rings out,
Till my throat is almost numb,
And O, for the touch of a list'ning ear,
Or the sound of a voice that is dumb.

Talk, talk, talk,
At the mouth of the telephone;
But the speaking squawk of that tyrant's tongue
Will never reply to my tone—until she gets good and ready."

A REPLY—BY TELEPHONIA.

"Yes, 'tis—
'Talk, talk, talk,
Till my brain is in a whirl,'
And I in *my* turn would utter
The thoughts of a telephone-girl.

O, well may the patrons complain,
Of the service being poor;
O, well may they storm and rave,
And vote it a terrible bore.

Yet, a five-minute stay 'mid the noise,
Is quite enough for them all;
But, what if they had to be here all day,
And answer ten-thousand calls.

'Hello! hello! hello!'
Not a moment's piece can we seize;
For when it isn't 'Hello,'
We must chant 'What is it, please?'

Till we wish that A. Graham Bell,
And his wonderful telephone,
And all the subscribers, those naughty fault finders,
To Jericho had gone."

Sept. 1, 1885. A. M. B.

Electricity and the Navy.

Speaking of the recent inspection by the Lords of the Admiralty, the London *Times* says: "It only remains to state, by way of conclusion, that remarkable progress has been made during the past twelve months in the general adoption of electric light apparatus in nearly all sorts and conditions of men-of war, so far as search-lights are concerned, though only a limited number are as yet fitted. The machines selected are also suitable for the internal lighting of the ships by the incandescent system, and there can be little doubt that the superior comfort and even the necessity of electric lighting will be soon universally recognized in a practical manner. There have been complete installations on board the Indian and other troop ships, the torpedo ram, 'Polyphemus,' and the 'Colossus,' and there are to be similar installation in the 'Collingwood,' 'Edinburgh,' and 'Imperieuse.' At the beginning of the year a carefully conducted trial of a week's duration of the 'compound wound' dynamos, known as the Victoria, was carried out in the 'Colossus,' which fully demonstrated that electric lighting on board ship, in addition to many other advantages over oil and candles, also possesses, in a striking degree, that of economy. These experiments, which were continued uninterruptedly day and night, were based on the actual requirements of a ship at sea, and doubtless hastened the decision to fit dynamos in all our fighting vessels. The cost of systematic trials of this kind has to be borne by the Admiralty. But the trials have already borne good fruit for the navy and country generally, and will amply pay the nation in the long run by reducing the expense of the lighting apparatus and the expenditure of fuel. It is also worth alluding to the other numerous and important electric appliances which have found a home on board our vessels of war. The ships are navigated from armored towers, or other protected positions, where are placed every requisite for fighting or navigating purposes. The commanding officer must be able to communicate readily by voice pipes with the battery or turrets, with the engine-rooms, magazines, and various other parts of the ship. But it has been thought expedient in some ships to supplement the ordinary means of communication by telephones, and different systems are under trial. The experiments must, however, extend over a considerable period, and under different conditions, before it can be absolutely decided which is the best method to adopt, or whether, indeed, telephones can be relied upon in such ships in cases of emergency. But it is also necessary that the officer shall not only be in a position to convey his orders from the tower to the engine-room and fighting stations, but that he shall also be certain that his instructions are understood and obeyed. This is accomplished by a system of electric telegraphs and revolution indicators. Electric steering telegraphs and tiller indicators are also necessary parts of a perfect equipment, and in order to enable the commanding officer to have complete control of the guns and torpedoes, so that he may be able to discharge all or any of them, as required, electric firing currents are fitted, by means of which he has only to press a key, and so complete the circuit, to fire the guns or eject the torpedoes at will. In turret ships it is, furthermore, important that the guns should not be fired when directed, as they must be while the turret is being rotated towards any part of the superstructure, or when they are depressed in some positions towards the deck. To prevent accidents arising from the non-observance in the heat of action of the precautions against accidents automatic electrical arrangements have been devised, by which it is simply impossible for the guns to be fired when at the 'dead points.' Additional electric combinations are necessary to enable the guns to be fired from the turrets instead of from the conning tower. These tend to further complicate matters on board, and without enumerating in detail other costly electric fittings of a man of-war, we have only to add that auxiliary conning stations are provided in case of disaster occurring to the main positions, to show how absurd and misleading it is to compare, as is sometimes done, the cost of constructing an armorclad with that of a merchant ship." One of points still under consideration as regards the "Inflexible," previously visited, is the expediency of completely lighting her by electricity. Their lordships' experiences on board the "Colossus" must have removed any vestige of hesitation on their part as to the transcendent superiority of the latest system of illumination, as the "Colossus" is actually ready for sea with the exception of the trial of her guns. When, on their lordships going on board, the whole of the interior spaces were lighted by incandescent lamps the effect was so extremely brilliant that the visitors could not refrain from expressing their satisfaction. Among the estimates of the various departments of the Admiralty the following items appear: For the extension of electric shop, £700; lightning conductors, £900.

—— The New Orleans *Daily States*, like a number of other dailies, realizes the advantages of electricity as an illuminant, and speaks as follows of the sensible action of the council of that city: "A good move of the present council was the inauguration of general electric lighting for the city. For the last half of the year 1884, the electric lights gradually crowded out the gas until it culminated in a fight with the gas company. In this the city was successful, and a contract was entered into with the Brush Company for 1885, whereby all the principal avenues were lighted by electricity, besides a number of prominent localities and the parks. Later, in 1885, the suburban lighting by electricity was awarded to the Louisiana Company for thirty months, and this service is in full operation. Early in this month the contract for lighting the entire city by electricity from Jan. 1, 1886, to Dec. 31, 1887, was awarded the latter company, and they are busy preparing the plant. In this respect the council has reared a monument of their work which will ever be a reminder of at least one good thing they did."

Aluminum.

NEW YORK, Sept. 5, 1885.

Editors of the Electrical Review:

In your issue of August 15th I notice an article, in the form of an interview with "a prominent mechanical engineer," on the subject of aluminum, which will amuse persons familiar with its use in the arts, while it is somewhat misleading to others.

Occasional articles in the daily press, giving rosy accounts of some new method of producing this metal at extremely low cost, has served to place it in about the same relation to metallurgy as the Keely motor is to dynamics.

While it is true that aluminum has properties which make it desirable for many uses, it also lacks qualities which make it questionable if it would affect the use or price of iron, even if it could be produced equally cheap.

Should the "prominent mechanical engineer" ever have occasion to "work" some of this metal, he will evidently be surprised to find that—

1st. It is much inferior to steel or iron in strength.

2d. It is quite the reverse of "stiff or rigid."

3d. Any alkaline matter will tarnish it, and the ordinary potash solution used in machine shops to clean grease off tools will readily dissolve it.

4th. It will not stand intense heat, as it melts at about 1,000° F., or at just the point of turning red-hot.

5th. Compared with copper, it is a poor conductor of electricity, being but little more than half as good.

6th. It is with more difficulty drawn into wire than most malleable metals.

7th. It cannot be soldered with either soft or hard solder, even by the skill of a plumber.

8th. Its chief good quality makes it a desirable material for flying machines.

Dr. Matthiessen gives the resistance of one foot of aluminum wire, one thousandth of an inch diameter, as 17.72 ohms, while one foot of copper wire, same diameter, is 9.94 ohms. H.

Another sale of the property and assets of the United States Telephone Manufacturing Company was made last week, the purchaser being Edward A. Stokes—the amount paid being $2,560. The property was sold some time ago for $100, but the sale was not confirmed by the court, and it was again advertised to be sold.

—— A new application of the incandescent light is reported from Germany, where it is said that the light has been applied to the internal illumination of the telemeter by a committee of the German army. The lamp is placed in a recess normal to the main lunette of the telemeter, and between the eye and cross wires. The light of the lamp passes through a small hole in the wall of the lunette, and illuminates the cross wires. This illuminating of the wires is found to double the distance that the telemeter will measure.

—— The electric railway, which has been in operation since April, 1884, between Moedling and Bruhl, in the suburbs of Vienna, is about to be extended to Hinterbruhl; its length will thus be increased from 3 to 4.5 kilometers. The system adopted is that of Messrs. Siemens, by which the current is produced at a fixed point and transmitted to the motors of the cars by metallic conductors along the route. The power is at present generated by five dynamos, each giving thirty amperes, with a difference of potential at the terminals of 500 volts.

—— There are now 270 arc lamps in use by the city of Brooklyn, 156 in the Eastern District, and 114 in the Western District. At present, there is no money for putting up any additional lights, and several of the Common Council resolutions cannot be wholly complied with on that account. Atlantic avenue, for instance, through its lower section, important a thoroughfare as it is, is only half lighted by a few electric lamps standing too far apart to be of very much use. Mr. Charles Cooper, the energetic president of the electric-light companies of Brooklyn, is the man who will see that the best of light is given, and all the city need to do is to assist him with reasonable appropriations.

ELECTRIC LIGHT NEWS

—— The "Municipal" system of electric lighting is to be given a trial by the city of Portland, Me.

—— The Germantown (Pa.) Electric Light Company is receiving bids for additional power, and will increase their capacity to 100 arc lights.

—— James Leffell & Co., of Springfield, Ohio, and 110 Liberty street, this city, have just issued a very complete and attractive illustrated hand-book of their double turbine water-wheel.

—— The Northern Electric Company, of Philadelphia, (Thomson Houston system) has recently added two new 45-light machines. The capacity of the plant will be increased to 200 arc lights.

—— The United States Electric Light Company is doing an excellent business in the West. Through their active agent, Mr. J. H. Reid, a contract has just been closed with Mr. C. E. Deeker, of Eureka, Kansas, for an arc plant, which will be put in at once.

—— Mr. Frank J. Norton, who has lately been in the employ of the Merchants' Electric Light and Power Company, of Boston, started last week for Peru. He has a five years' engagement with the American Electric and Illuminating Company. His former associates, both his employers and his fellow-employes, surprised him by the gift of a handsome gold watch. They are all sorry he has gone, but believe he will prosper.

—— A contract has been signed by the American Electric Manufacturing Company and E. A. Noyes, chairman of the street-lighting committee of Portland, Me., providing for the lighting of the streets of that city by electricity at a cost of $25,000 per year. This is $2,500 per year less than was asked by the gas companies.

—— The Louisiana Electric Light and Power Company, of New Orleans, is pushing matters in the lighting contract for 1886 and 1887. The contract for all the necessary poles will soon be awarded, and also for increased power. It is understood that three Corliss engines, aggregating upwards of 1,000 horse-power, will be added, with the necessary plant of boilers. There will therefore be nothing to do except erect the poles and lamps, wire the district and add the engines. The dynamos from the Exposition plant of the company are there, and have a capacity for 900 lamps, or 400 more than are required for the contract of 528 for the entire city. It is thought that everything will be ready and in running order by December, and on January 1st New Orleans will, at one instant, be lighted all over with a blaze of electricity.

—— The first of October next will witness in Bloomington, Ill., another stride toward progressive city regulations. The electric light will then for the first time be introduced as a street-lighting medium, and will entirely supersede gas for that purpose. This movement is in the line of the metropolitan improvement, and will afford this city the best lighting medium now known or used. At first an effort will be made to light the streets of Bloomington with 130 lamps, which it is thought will be sufficient, but provision has been made for an increase to 150. The globes will be strung at the intersection of streets. The distribution of lights has been so made as to offer as near as possible equal illumination to every part of the city. The Thomson-Houston Company intend to make the electric lighting of this city as satisfactory, complete and successful as it can be made. They have put in machinery and appliances making their plant there perfect and adequate to do the work required of it. Mr. McTiggan, the Thomson-Houston representative, declares that the company will make their work so thorough that the Bloomington electric light will commend the system to other cities.

NATIONAL TELEPHONE EXCHANGE ASSOCIATION.

Long-Distance and Short-Distance Talkers in Council—Providence Alive With Active Telephone Officials.

VALUABLE PAPERS READ FOR THE "BENEFIT OF THE ASSOCIATION ONLY"—THE LEADING POINTS PRESENTED WILL BE FOUND HEREWITH.

Providence, Rhode Island, is a city of some hundred thousand inhabitants, where all is quiet and peaceful. That was a sudden, though we trust not rude, awakening that this, the chief city of the smallest State in the Union received last Tuesday, when the telephone boys, with their wild, weird dialect and electrical gestures, burst upon her unprotected domain, and bivouacked at the Narragansett House. Here they were hospitably received, the arrangements made in advance by the Providence Telephone Company, particularly by Supt. A. C. White, proving satisfactory to all attendants. There were the usual happy greetings and cheery expressions, the universal opinion being expressed that the telephone officials had found the elixir of youth, and instead of aging with the increase of years were constantly growing younger and (were it possible) brighter. Some of them, when questioned about dividends, and hail storms, and "reconstruction," would only be cast down long enough to explain that the future outlook was decidedly more rosy, and with less royalty to pay to the American Bell Company, and improved and less expensive systems, they expected to resume dividends and defy tornadoes in the not far distant future. There seemed to be a feeling in the air that the close times of the past two years were slowly changing for the better, and that the telephone companies would receive an excellent share of this returning prosperity.

There were present attending the meeting and mingling with the members the following named gentlemen:

C. J. French, Boston, Assistant Gen'l Manager American Bell Telephone Company.

Thos. Sherwin, Auditor American Bell Co.

W. R. Driver, Treasurer American Bell Co.

Dr. W. W. Jaques, Boston, Electrician American Bell Telephone Company.

Edward J. Hall, New York, American Telegraph and Telephone Company.

Henry Bentley, Philadelphia, Pa., President Bell Telephone Company, of Philadelphia

Dr. S. M. Plush, General Manager Bell Telephone Company, of Philadelphia.

C. F. Cutler, Brooklyn, N. Y. President New York and New Jersey Telephone Company.

W. D. Sargent, Brooklyn, N. Y., General Manager New York and New Jersey Telephone Company.

W. H. Eckert, New York, General Manager Metropolitan Telephone and Telegraph Company.

H. Metzger, Pittsburgh, Pa., General Manager Central District and Printing Telegraph Company.

William Ker, Harrisburgh, Pa., General Manager Pennsylvania Telephone Company.

H. L. Storke, New York, President Empire State Telephone and Telegraph Company.

D. I. Carson, New York, General Superintendent Southern Bell Telephone Company.

James Merrihew, New York, East Tennessee Telephone Company.

Samuel M. Bryan, Washington, D. C., Chesapeake and Potamac Telephone Company.

J. N. Keller, Boston, Mass., General Manager New England Telephone Company.

G. F. Durant, St. Louis, Mo., General Manager Bell Telephone Company, of Missouri.

C. N. Fay, Chicago, Ill., General Manager Chicago Telephone Company.

B. E. Sunny, Superintendent Chicago Telephone Company.

Capt. G. M. Stone, Cincinnati, Ohio, General Manager City and Suburban Telegraph Association.

S. M. Cowles, Buffalo, N. Y., General Manager Bell Telephone Co., of Buffalo.

H. P. Frost, New Haven, Conn, General Manager Southern New England Telephone Company.

Morris F. Tyler, New Haven, Conn., President Southern New England Telephone Company.

E. M. Barton, Chicago, Ill., Vice-President Western Electric Company.

W. R. Patterson, Chicago, Western Electric Company.

T. B. Doolittle, Bridgeport, Conn., Special Agent American Bell Telephone Company.

Charles R. Truex, Montclair, N. J., Special Agent American Bell Telephone Company.

R B. Boyd, Boston, Special Agent American Bell Telephone Company.

J. M. Brown, Boston, Special Agent American Bell Telephone Company.

E. V. Cherry, Cincinnati, Vice-President Standard Electrical Works.

W. N. Eastabrook, Elmira, N.Y., General Manager N. Y. & Pa. Telephone Co.

Samuel Ivers, New Bedford, Mass., President Southern Massachusetts Telephone Company.

A. P. Sawyer, Newburyport, Mass.

W. A. Jackson, Detroit, General Manager Telephone and Telegraph Construction Company, of Michigan.

E. B. Field, Denver, General Manager Colorado Telephone Company.

Harry Thayer, New York, Manager Western Electric Company.

F. W. Harrington, New York, Western Electric Company.

Charles A. Rolfe, New York, Western Electric Company.

Eugene F. Phillips, Providence, President American Electrical Works.

W. H Sawyer, Providence, Secretary American Electrical Works.

F. A. Angell, Providence, American Electrical Works.

Henry Howard, President Providence Telephone Company.

Charles T. Howard, Secretary and Treasurer Providence Telephone Company.

J. W. Duxbury, General Manager Providence Telephone Company.

F. H Gardner, Assistant General Manager Providence Telephone Company.

A. C. White, Superintendent Providence Telephone Company.

H. D. Stanley, Bridgeport Brass Works.

H. B. Lytle, New York, Lytle & Co.

George E. Betts, Bridgeport, Manager.

E. T. Gilliland, Boston.

Stephen D. Field, New York.

I. H. Farnham, Electrician New England Telephone Company.

W. J. Denver, Boston, Assistant General Manager New England Telephone Company.

Col. Parker, Boston, Superintendent New England Telephone Company.

Charles Williams, Jr, Boston, W. E. Co.

S. B. Gifford, Louisville, General Manager Ohio Valley Telephone Co.

J. B. Speed, Louisville, President Bell Telephone Company, of Louisville.

Joel C. Clark, New York, Secretary and Treasurer New York and New Jersey Telephone Company.

Loren N Downs, President ELECTRICAL REVIEW, New York.

Charles W. Price, Associate Editor ELECTRICAL REVIEW, New York.

John W. Beane, Electrician ELECTRICAL REVIEW, New York.

W. J. Johnston, Editor *Electrical World*, New York.

Ralph W. Pope, Associate Editor *Electrician and Electrical Engineer*, New York.

John A. Seeley, Electrician Metropolitan Telephone Company.

W. A. Childs, New York, Law Telephone Company.

J. H. Bunnell, New York, Bunnell & Co.

Col. H. C. Adams, New York, Holmes, Booth & Haydens.

C. E. McCluer, Richmond, Va.

Theo. Mace, New York, Electrical Supply Company.

W. B. Habirshaw, New York, General Manager Triplex Insulated Wire and Rubber Company.

W. Wolcott Marks, New York, Bishop Gutta-Percha Company.

Clark B. Hotchkiss, New York, Kerite Cable Company.

R. K. Dana, New York.

J. D. Easterlin, Charleston, S. C.; C. E. McCluer and W. J. Cole, Atlanta, Ga., District Superintendents Southern Bell Telephone Company.

A. B. Uline, Albany, General Manager Hudson River Telephone Company.

Geo. Wiley, New York, Standard Underground Cable Company.

Willard L. Cardle, New York, Okonite Company.

W. O. Callender, New York, Callender Insulating Company.

J. D. Bailey, New York, Telegraphic Time Company.

E. B. Baker, Superintendent Southern New England Company.

J. J. Carty, Boston, New England Telephone and Telegraph Company.

C. F. Size, Montreal, Bell Telephone Company of Canada.

A. Wilson, Jr, Chesapeake and Potomac, Baltimore.

Colonel Fred. Mason, Bridgeport Brass Works.

J. C. Wilson, Philadelphia, Clark Insulated Wire Company.

John M. Pendleton, Equitable Electric Company, New York.

H. M. Smith, Washburn & Moen Company.

W. H. Cull, Superintendent Hudson River Telephone Company.

Henry L. Shippy, Manager John A. Roebling's Sons' Company.

TUESDAY'S SESSION.

The convention assembled at 11 A. M, in the parlor of the Narragansett House—Morris Tyler presiding. Ex-Governor Howard, of the Providence Telephone Company, welcomed the members of the association to the city in pleasant words, and also, in behalf of his company, invited them to enjoy a ride down the bay on Thursday afternoon. This was acknowledged by Mr. Tyler, who, in behalf of the convention, thanked Governor Howard for his welcome and the Providence Company for the entertainment, which would be most unanimously accepted.

After the call of the roll of membership new members were proposed. The American Telephone and Telegraph Company, whose business was "between large cities not yet named," as the chairman put it, was elected a member, and Mr. T. N. Vail was unanimously elected an honorary member, the chairman stating that in the case of Mr. Vail the mention of his name was all that was necessary. The Callender Insulating Company was also elected to honorary membership.

Secretary W. D. Sargeant then read his report, which showed a membership of 41 active members and 30 honorary members. He stated that the programme of the present meeting differed from those formerly held in respect to the presentation of papers; heretofore volunteers had been depended on, but on this occasion a number of gentlemen would present papers prepared for the occasion. Although the telephone interests, like other interests, had been passing through a very discouraging depression, yet this should only serve to more closely unite this organization. The secretary alluded to the agreeable meeting of the licensees with the American Bell Company in June, which, however, had kept some of the members away from the present meeting, as they could not spare time to attend both. The treasurer's report, he stated, showed a balance of $37.35 in the treasury, with uncollected dues amounting to $630.

The report of the Executive Committee, which had just held a meeting, was then presented. It was decided to employ a secretary at a salary of $100 a month, whose business would be to take particular care and interest in the objects of the convention—gathering and compiling matters of importance. It was also recommended that the annual dues be made $50 per annum for each member, the constitution in this regard to be changed at the next meeting.

The report was accepted and filed.

The chairman stated that an invitation had been received from the American Bell Telephone Company, asking the convention to visit Leicester, Mass., on Saturday, and inspect the new "village system" of telephony. (This is described in another column.) A special car will be furnished for the occasion, he stated, by the parent company.

Mr. Tyler then spoke at some length in an interesting manner, and in the line of reminiscences For five years, since 1880, these conventions had been held. The first meeting at Niagara was largely attended, and, although they had a good time, yet managed to do considerable business. "When we met there," said the president, "we were substantially strangers, and all in a state of enthusiastic uncertainty. He did not think any company could put their hands upon their figures and say it had made a cent or expected to make a cent. The members were full of hope, but when analyzed it was exceedingly airy. In the spring of 1881 the conditions were different, matters having become crystallized, the opposition of the Western Union Company having been substantially withdrawn. In 1881-2 we were the most self-contented convention ever assembled in one room. All had made money and saw an indefinite expansion of business a long way off. In 1883 we were not so enthusiastic, and in 1884, at Philadelphia, were blue. We have been in periods of eager expectancy, in the flush of almost unexpected success, and now find steady, unremitting work, constant anxiety and careful forecast not only for to-morrow, but for next year's business, as the result of an established concern with large interests to care for." President Tyler then discussed the relations of licensor to the licensee in an intelligent and comprehensive manner, and believed that something should be done to regulate their business relations. In conclusion, he said that in many respects the telephone business was dependent upon the general business of the country. He had seen what he believed to be an honest and permanent revival, not speculative. "It is our business to keep our eyes open and profit by the experiences of the past, so that in a reasonable time we all shall find ourselves on that delightful basis on which some licensees find themselves, where we can pay a dividend on all the stock after deducting both expenses and construction."

Election of officers followed, and resulted in the election of the following-named gentlemen to serve the ensuing year:

President—C. N. Fay, General Manager Chicago Telephone Company, Chicago.

Vice-President—George F. Durant, Bell Telephone Company, of Missouri, St. Louis.

Secretary—Gen. C. H. Barney, Superintendent New York and New Jersey Telephone Company, Jersey City.

Treasurer—H. L. Storke, President Empire State Telephone Company, New York.

Mr. Durant at first thought that two officers should not come from the West, and asked to be permitted to decline, but the convention would not hear of it, the chairman stating that this was the first case on record where a St. Louis man desired to decline an office because a Chicago man was elected. (Laughter.)

Mr. Cutler, who nominated Mr. Storke as treasurer, stated that a man so capable and willing to make up all deficiencies that might occur in the treasury should not be permitted to go out of office, and asked for Mr. Storke's re election This gentleman was willing to serve, provided he would'nt be expected to make up the new $50 dues of the members, should any fall behind. After this amusing passage, Mr. Storke was unanimously re-elected.

Morris Tyler and B. E. Sunny, were elected members of the Advisory Committee, and James Bigler, R. M. Bailey, C. F. Cutler and H. M. Metsgar, members of the Executive Committee.

The officers assumed their offices, Mr. Durant presiding in the absence of Mr. Fay.

Mr. Sargeant said St. Louis was virtually settled upon as the place of the next meeting, the invitation having been extended two

years ago. Mr. Cutler desired to know if that invitation still held, and Mr. Durant assured him that it did. St. Louis was then decided upon as the place of the next meeting, and, later, the first Tuesday in September as the time.

While debating the best time to meet in St. Louis, Mr. Cherry suggested that the time should be later in the month than usual, for the first of September, as it was very warm at that time in St. Louis. Mr. Lockwood explained that need not be a hindrance as there was a delightfully cool "beer cave" in St. Louis that the members could all visit and easily keep cool.

The committee on "Wire Gauges" then reported through the chairman, Mr. Sargent, who stated that he had corresponded with a number of leading wire manufacturers, and users of wire, and, while they all seemed desirous of securing a standard gauge, there seemed to be a difficulty in settling on a gauge. He recommended the adoption of the new English standard gauge, although Mr. Doolittle, another member of the committee, preferred the American.

Mr. Carson, the third member of the committee, agreed with Mr. Sargent.

Mr. Hotchkiss explained what the new English gauge was, and Mr. Callender moved that a committee be appointed to confer with the Electric Light Association on the matter, and thereby be enabled to adopt a gauge satisfactory to all.

Mr. Sargent didn't think this necessary. The Birmingham gauge, he stated, was the old English gauge standardized.

Mr. T. D. Lockwood opposed the motion of Mr. Callender with considerable vigor, stating that he thought it would be conferring an unmerited compliment on the Electric-light people. Thought they had shown perfect disregard of the telephone interests.

The convention adjourned until 3 o'clock, without deciding the matter.

TUESDAY AFTERNOON SESSION.

The meeting opened at 3 o'clock P. M., with Mr. C. U. Fay in the chair.

The discussion upon the resolution previously offered, that the association adopt some uniform standard wire gauge was continued.

Mr. T. B. Doolittle of the American Bell Telephone Co., spoke quite forcibly against the adoption of the new English standard wire gauge, and exhibited to the meeting a chart showing graphically, on an enlarged scale, the lack of uniformity in variations of the successive sizes of the English Standard and Washburn & Moen Standard, and on the contrary the uniformity of the American Brown & Sharpe gauge. Messrs. Brown & Sharpe had taken up the subject about 20 years ago, and had worked out a good practical gauge, avoiding the defects of the gauges then in use, and embodying their good points. Their system was based on variations of thousandths of an inch, rising in a regular even succession. This gauge, the gentleman stated, was in use by a host of manufacturers of brass and copper wire in the United States, and gave general satisfaction. Much confusion, he said, had arisen from the use of numerous wire gauges throughout the country, each manufacturer for himself. In speaking upon the subject with Mr. Washburn, of Washburn & Moen, that gentlemen expressed himself anxious for the adoption of a standard universally agreed upon, and thought he simply voiced the opinion of the wire manufacturing element generally.

"Why turn to foreign countries for a gauge," Mr. Doolittle said, "when we have good ones of our own at home, for instance, the micrometer and B. & S. gauges, both American inventions?" In his opinion it would be many years before the English standard gauge would be generally adopted, even in England. All understood the American gauges, and the adoption of the English gauge would, he thought, make confusion more confounded.

Mr. Sise, of Montreal, expressed the view that the English standard gauge had passed into practical use more fully than we on this side of the water were aware of. The Germans and French, as well as the English, used it; the French perhaps not so generally as the other two, but the bulk of the wire drawn in Europe was manufactured in England and Germany. If he ordered No. 9 wire for instance from foreign manufacturers, and did not express the gauge, English standard gauge would be sent.

Mr. C. B. Hotchkiss agreed with the previous speaker, and stated that he had supplied considerable wire to foreign parties, and that all the specifications called for English wire gauge.

Mr. Shippey thought the adoption of some standard gauge throughout the country very necessary, and that this association in taking the initiative step in that direction would, by its influence, greatly aid the object in view.

All telephone companies at least would then order their wire according to one and the same gauge.

Mr. Sargent, of Brooklyn, stated that the greater part of the confusion arising on the wire question was due principally to the fact that each wire company adopted a gauge to suit its own sweet will.

What we want is a simple uniform gauge for all, both at home and abroad, and as he did not think the English could be induced to change their wire gauge, bound as it is by law, we should, for the sake of uniformity, conform to the English standard gauge owing to its universal adoption in foreign countries.

Mr. Doolittle could not agree with Mr. Sargent on this point, and thought that as we had a gauge of our own which we were familiar with, it would be starting over again to very little purpose.

Mr. Barton spoke somewhat in review of the subject, and to the point. He was opposed to giving up what had been gained in the way of experience with our own gauges to adopt a foreign one. The English standard gauge was in fact mainly theoretical in its application at present, and it would take years before it would come into direct operation. He did not think it wise to bring about additional confusion simply to perhaps benefit posterity. For his part he would prefer to see a movement in the direction of the adoption of the Brown & Sharpe gauge, and thought that from its perfection the chance of its general adoption was great. The discussion was continued by Messrs. Fay, Eckert, Durant, Doolittle, Callender, Metzger, Sargent and others, when the original motion was put to the meeting, and the English standard wire gauge adopted.

Mr. Clark Hotchkiss offered the resolution that the secretary be instructed to prepare and issue a circular to the members giving the weights of the different sizes of wire under the adopted gauge, and also their resistances per mile for both copper and iron wires, using the Mathiessen standard.

Mr. Callender suggested that the other electrical associations be notified of the action of this association.

Mr. Barton also requested that manufacturers of wire be included. The motion was adopted as amended.

The recommendation of the Executive Committee that the assessment for the ensuing year be $40 for each member, &c., then came before the association. This brought forth considerable discussion, in which the meeting was highly entertained by the particularly witty remarks of Messrs. Keller, Estabrook and Storke.

The committee's recommendation was finally adopted, with the amendment that this assessment could be modified by the action of the Advisory Committee, but in no one case is a remittance of assessment to exceed $20. Several other recommendations of the Executive Committee relating to the annual dues and a salary of $100 per month pertaining to the secretaryship, were disposed of.

An invitation from the Pawtucket Thread Company, to visit their works, was accepted by the members, with thanks from the association.

At 5 P. M., upon motion, the meeting adjourned.

WEDNESDAY'S SESSION.

Several amendments to the constitution proposed by Mr. Ed. Hall, were laid over until next year.

Mr. G. L. Wiley, of the Standard Underground Cable Company, was elected an honorary member.

In the absence of Mr. Angus Hibbard, the author, Mr. W. D. Sargent read the paper on "Some Practical Results of Long-Distance Telephoning."

The fabulous tales of the new wonder, when long-distance telephoning was first proposed, were humorously commented on. In 1878-9 the extension of extra territorial lines commenced on an economical plan. Capital came to the assistance, and the telephone was most rapidly developed. Now there are 1,252 exchanges in the United States. The paper dealt at some length with the details of the extra-territorial plants of the Chicago Telephone Company, the Wisconsin Company, the Michigan Company, New York and New Jersey Company and Buffalo Company. About 100 miles is the average distance, but some exchanges have lines running 150 miles and over. The best-paying plants are those where the lines enter exchanges of 500 or more subscribers. The average length of conversations is two minutes each, much longer time being required in connecting and disconnecting. Mr. Hibbard favored the toll ticket. He claimed that the most perplexing feature was "induction," different in degree and annoyance in different States. The inductive effects of long parallel lines was an annoying feature not yet remedied. Hard-drawn copper wire was the best for long distance, and could be worked a distance of 200 to 250 miles. The annunciator coils should be kept away from these lines. Good operators are particularly necessary in long-line work. The author thought the day was not far distant when the troubles of this branch of the business would be overcome.

Mr. Storke doubted if all had been charged to toll lines that should. The exchanges had a large portion of these expenses to bear. Messrs. Sargent and Fay agreed with this.

Mr. Lockwood said there were two new induction sources, one in the nature of screeching noises on the long line between New York and Boston; the other the induction from the third rail of the street-car line where the Daft motor was being tested at Baltimore.

Mr. Wilson, of Baltimore, said this latter annoyance would compel the removal of their entire line. The distance that the street-car line followed the telephone wires was 2½ miles, and the lines were useless when the third rail was charged with electricity. Had tried every remedy except the metallic circuit.

Capt. Stone suggested that the Baltimore Company refrain from moving their line until the Daft people were through experimenting. He didn't believe this motor would prove a commercial success.

Mr. Callender stated that a series of experiments made by his company to get rid of induction, had proved very successful. They used one return circuit for several wires.

Mr. Cowles, of Buffalo, said that he had found the limit to be 60 miles for long distance talking, although had talked 150.

Mr. Sise, of Canada, had secured the best results with a No. 9 wire, on 10 feet cross arm, without insulators. Talked 200 miles easily.

The question of blanks for extra-territorial work was discussed, Mr. Sise saying that it took nearly 25 cents' worth of book-keeping to get 25 cents in business.

Mr. McCluer, of Richmond, thought metalliferous veins had something to do with relieving by induction disturbances on long lines.

Mr. Metzgar, of Pittsburgh, said 100 miles was the limit in his territory.

In reply to inquiries, Mr. Lockwood said the metallic circuit, properly constructed, was a cure for nearly all the troubles of distance telephoning. This would require an entire change, however, of appliances for central offices, etc.

Mr. Frost said that metallic circuits, he had found, would interfere with one another when adjacent.

Mr B. Sunny, of Chicago, read a paper on "Exchange Statistics." The paper included a number of interesting points concerning the leading exchanges, giving the number of subscribers in each city, and the ratio of increase for the year, and the connections made daily. The author regretted that some of the companies had neglected to report. The best average of calls per subscriber was found to be at Detroit, where it amounts to 10 and $\frac{6}{10}$ calls per day. The expense per 100 messages had nearly all been reduced as compared with last year, the cost running from 21 cents to 66 cents. Trunk lines had increased from 1893 last year, to 1,712. The cord board, it was found, was rapidly supplanting the plug board. The average pay of linemen was shown to be $2 per day; of "combination" men, $2.21. The removal of resistance in the Chicago Telephone Exchange, fully described by our Western correspondent in the last issue of the REVIEW, was alluded to in the conclusion of Mr. Sunny's valuable paper.

Mr. Storke's paper on "Legislation" followed. He divided this into five classes:

1st. Laws regulating relations with telegraph companies.

2d. Laws relating to taxation.

3d. Laws relating to appointment of commissions.

4th. Laws on underground wires.

5th. Laws fixing rates.

A general review of the legislation that had been enacted was given in Mr. Storke's usual entertaining manner.

In the discussion which followed, Mr. Durant and Mr. Fay gave their experience with legislation, the former saying that it was best to be frank and friendly with the gentlemen in power. Bills should be *defeated*, not amended, as that was dangerous. The St. Louis company is now paying 2½ per cent. of gross receipts to the State. Mr. Fay favored being represented at State legislatures by capable men, as part of the legitimate business of telephone work.

Col. Eckert, of New York, presented a brief paper describing the underground system in use by the Metropolitan Company. They had at one exchange 220 miles of the Patterson cable, the longest length being 1,939 feet, the shortest 1,300 feet. There were 868 conductors in all, 629 in use. Each cable had from 50 to 100 wires, and were placed in wooden conduits, three feet below the surface. The Edison underground system of the Twenty first Street Exchange consisted of 194 miles of 981 conductors—561 in use. Longest length, 1,694 feet; shortest, 797. There are from 100 to 271 conductors in each cable. In the Brooks system, at the Spring Street Exchange, there were two 4-inch pipes, containing 380 conductors each, 200 miles of it having been laid; 760 conductors in all were down, 501 in use. Longest length, 2,443 feet; shortest, 365. All these systems were giving satisfaction. The total of underground wire of this company was 614 miles.

The convention adjourned to 3 P. M.

WEDNESDAY AFTERNOON SESSION.

The association met for its afternoon session at 3 P. M., President Fay in the chair.

The next business in order, as announced by the President, was a paper by Mr. W. R. Paterson, on "The Underground Problem." This paper was full of useful information and practical suggestions. There were three principal obstacles to be met with in the construction of underground conductors, namely: scientific, practical and financial. These he treated in detail, taking up the subjects of induction, retardation and escape, and stating that, in his opinion, a greater part of the cross talk heard in telephone circuits was due more to escape than induction.

High initial resistance he considered as the best guarantee of efficiency. The use of symmetrically placed wires was undoubtedly an absolute cure for induction, but we had also to take into consideration the fact that the resistance was greatly increased thereby. What was the best way to protect wires under ground was about as easy to decide, the speaker said, as to decide the best way of protecting human life from accident. The

(*Concluded on page 5.*)

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING SEPT. 1, 1885.

325,368 Machine for making tubing and cord and for covering telegraph and other wires; Vernon Royle and John Royle, Jr, Patterson, N. J.

325,389 Circuit for arc and incandescent electric lights; Harold P. Brown, Chicago, Ill.

325,390 Arc and incandescent lighting system; Harold P. Brown, Chicago, Ill.

325,391 System for operating incandescent lamps; Harold P. Brown, Chicago, Ill.

325,423 Electric arc lamp; Norman McCarthy, Hoosick, N. Y., assignor to John B. Tibbitts, same place.

325,424 Electric arc lamp; Norman McCarthy, Hoosick, N. Y., assignor to John B. Tibbitts, same place.

325,463 Annunciator; Henry E. Waite, New York, N. Y., assignor to Charles F. Livermore, same place.

325,495 Underground electrical conductor; D. Brooks, Philadelphia, Pa.

325,520 Apparatus for testing electrical circuits; I. H. Farnham, Boston, Mass., assignor to the American Bell Telephone Co., same place.

325,540 Socket and connection for electric-light circuits; Godfrey Hess, Williamsport, Pa., assignor of three-fourths to Henry Metzger, same place, and George W. Dyer, Washington, D. C

325,569 Device for lighting gas by electricity; Francis H. Root, Hyde Park, Ill.

325,576 Electric regulator Wm Stanley, Jr., Englewood, N. J.

325,619 Dynamo-electric machine; Charles L. Fr. Mueller, Milwaukee, Wis., assignor of one-half to Emil Schandein, same place.

325,630 Insulating and anti-induction tube for electric conductors; Frank B. Rae, Newark, N. J.

325,639 Electric alarm; James J. Wood, Brooklyn, N Y.

325,641 Electric motor; Leonidas G. Woolley, Kalamazoo, Mich.

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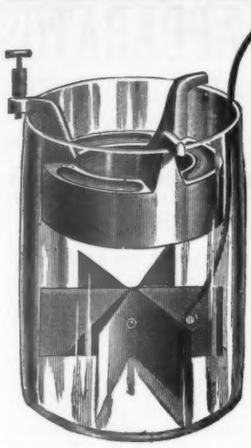

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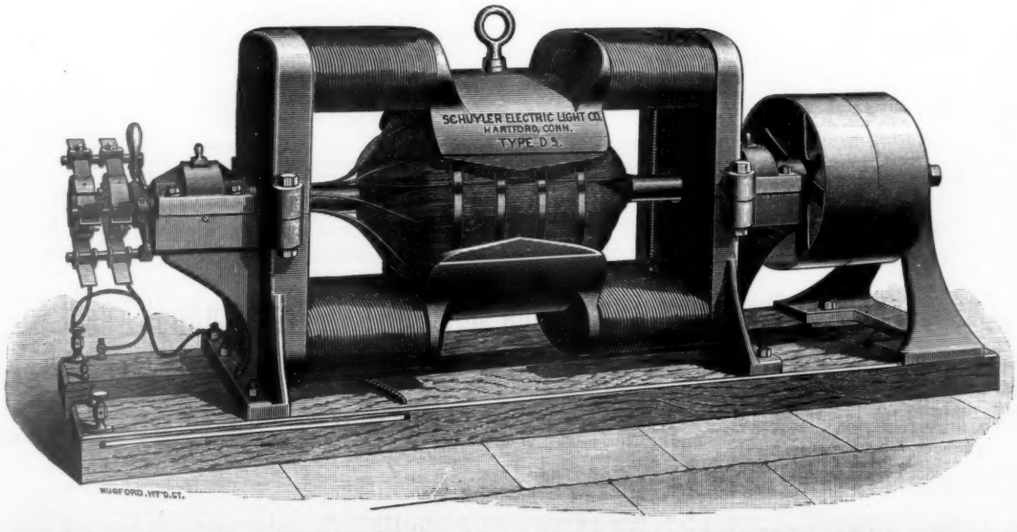

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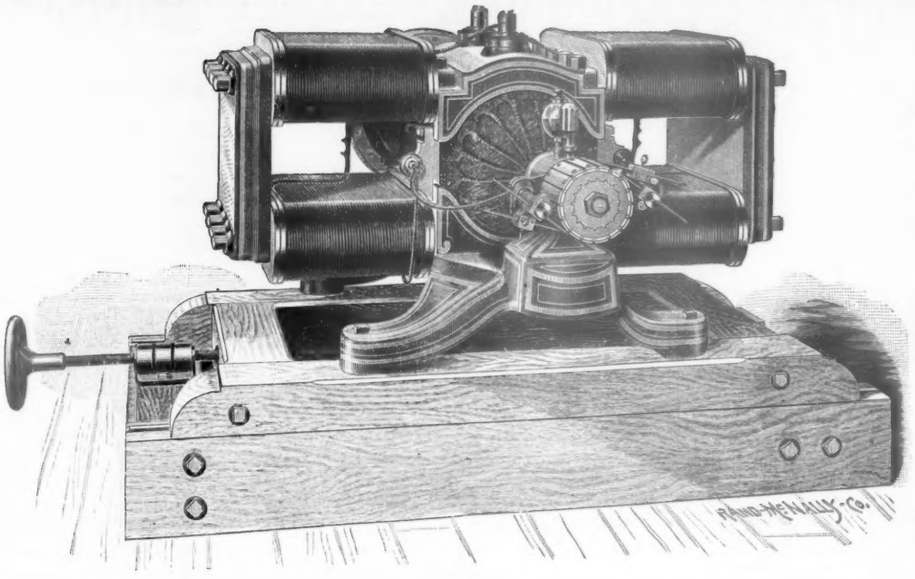

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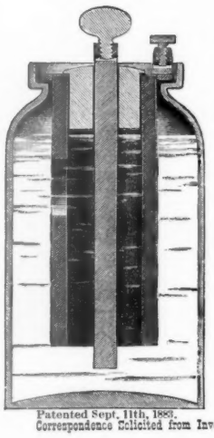

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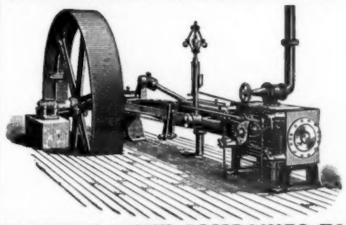

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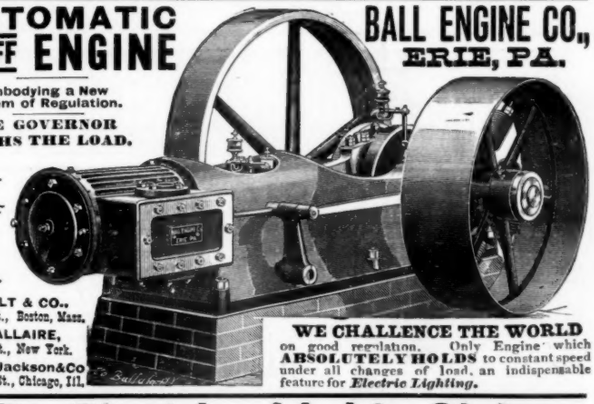

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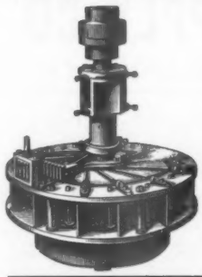

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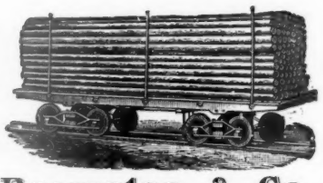

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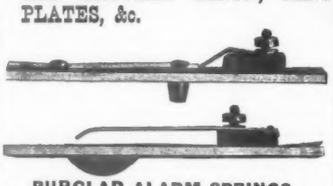

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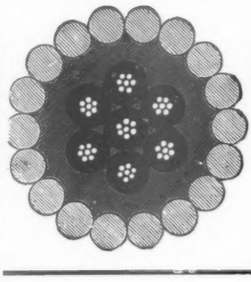

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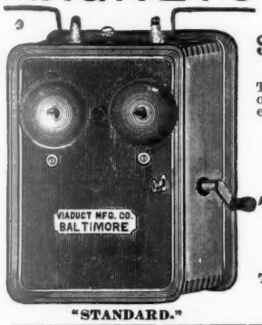

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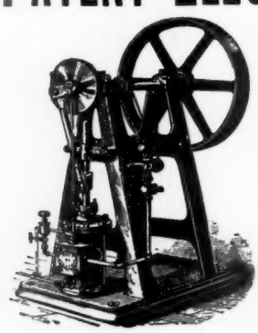

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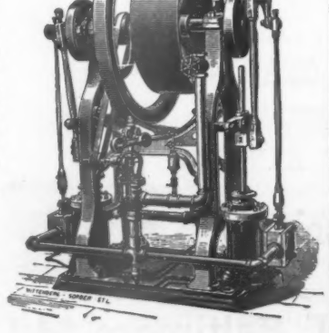

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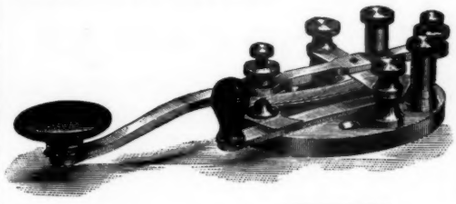
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